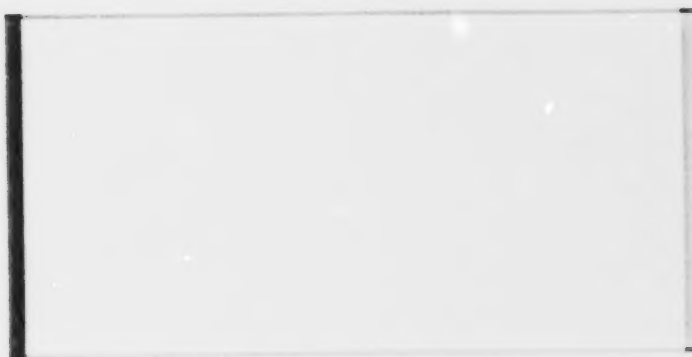


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**BRUCE GS "B" COMMISSIONING BIOLOGICAL
STUDY YEAR I, 1983**

Report No 86-166-K

H. Balesic
Biologist
Biological Research Section
Chemical Research Department

ABSTRACT

Studies of the aquatic environment were carried out at the Bruce GS "B" site from May to December, 1983, the first year of commissioning, during which 1 to 3 CCW pumps were being operated with no units in service. Continuous monitoring of water temperatures showed rapid, large-amplitude fluctuations during the months of June, July and August similar to those observed in pre-operational years. Water quality parameters were generally similar to those observed in 1979-81, as were abundance and community composition of adult and juvenile fish. However, increases in relative abundance of round whitefish, burbot and longnose dace were apparent. Acoustic surveys made in the summer with minimal pumping showed clustering of pelagic fish schools, presumed to be alewife, in the vicinity of the intake depression, but did not indicate that either pelagic or demersal fish favoured the intake depression itself.

job	file	date	report no.
740634-123-401-92	837.321 BRU	August 1, 1986	86-166-K



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EXECUTIVE SUMMARY

BRUCE GS "B" COMMISSIONING BIOLOGICAL STUDY YEAR I, 1983

H. Balesic
Biological Research Section
Chemical Research Department

An aquatic study was conducted in the vicinity of Bruce GS "B" from May to December, 1983, the first year of commissioning. During this period station activities which could influence the aquatic environment were limited to pumping without addition of waste heat (maximum of $47 \text{ m}^3/\text{s}$). This study represents the first year of a four year program of aquatic and terrestrial studies being conducted during the commissioning period of Bruce GS "B" (1983-86). The objectives of these studies, as requested by Environmental Studies and Assessments Department, Design and Development, were: i) to provide continuity between pre-operational (1979-83) and post-operational (1987-89) studies, and ii) to identify any significant environmental changes resulting from construction or station operation during the commissioning period.

Physical-chemical characteristics examined included water temperature, currents and water chemistry. Seasonal temperature patterns in the nearshore area of Bruce GS "B" were similar to those observed in preoperational studies. Temperatures at shallow depths (2-3 m) rose from approximately 5°C at the end of April to a maximum of $22-23^\circ\text{C}$ in early August, declining again to 5°C by the end of November. Extreme temperature fluctuations produced by internal sieches, upwelling and downwelling events typical of exposed nearshore environments of the Great Lakes were observed from June through August. Water quality parameters were generally similar to those observed during the pre-operational period (1979-81). Exceptions included the nutrients silica (higher in 1983) and various forms of nitrogen (lower in 1983).

job	file	date	report no.
740634-123-401-92	837.321 BRU	August 1, 1986	86-166-K

Investigation of biological characteristics was limited to adult and juvenile fish, which were sampled by gill net, beach seine and acoustic census. Fish abundance and community composition were similar to those observed in preoperational netting. Alewife dominated the catch, followed by longnose sucker, longnose dace, yellow perch, spottail shiner, white sucker and gizzard shad. The relative catches of round whitefish, longnose dace and burbot were substantially higher than those during the preoperational period. Age 0 alewife, which formerly made up a large proportion of summer beach seine catches, were not taken in 1983 sampling. The majority of round whitefish were adults greater than 300 mm in fork length caught from September to December. Post-spawn whitefish were first taken in mid-December, when they made up 90% of the catch.

Results of acoustic surveys in the vicinity of the submerged intake with minimal pumping ($19 \text{ m}^3/\text{S}$ or less) suggested that in some cases pelagic fish schools, presumed to be alewife, were clustered in the vicinity of the intake depression. There was no evidence that either pelagic or demersal fish favoured the intake depression itself, although scattered individuals and in two cases small aggregations were recorded within it.



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ontario hydro research division

To Dr. W.R. Effer
Manager, Environmental Studies
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Design and Development Division

BRUCE GS "B" COMMISSIONING BIOLOGICAL STUDY YEAR I, 1983

1.0 INTRODUCTION

Bruce GS "B" is a 3200 MW nuclear generating station under construction on the northeast shore of Lake Huron, and is part of the Bruce Nuclear Power Development. This report presents results of the first of four years (1983-1986) of studies of the aquatic and terrestrial environment during the period of commissioning of Bruce GS "B". Commissioning activities in 1983 consisted of pumping and construction on land. One CCW pump and two service water pumps (total flow $19 \text{ m}^3/\text{s}$) associated with Unit 6 were operating during most of 1983, while up to two additional CCW pumps were operated for up to 4 weeks late in the year. Detailed information may be obtained from operator logs stored in Bruce GS "B" files. The first generating units did not become critical until May 29, 1984.

The Bruce GS "B" commissioning studies are part of a series of environmental studies at that site, beginning with the Environmental Assessment included in the proposal for Bruce GS "B" in 1975, and ending with the final Environmental Assessment projected for 1990. The latter will be based on results of pre-operational (1979-1983; summarized in OHRD Report Draft), commissioning and post-operational (1987-1989) studies. This will be in the form of an updated assessment of the entire BNPD complex. The objectives of the commissioning program (1983-1986) are twofold: i) to provide continuity between preoperational and post-operational data and ii) to identify significant changes resulting from construction and operation of the station during the commissioning period.

Only the aquatic environment was investigated in 1983. Physical, chemical and fish data were collected to provide continuity with selected aspects of the preoperational data

base; distribution of fish near the submerged intake was determined on several occasions prior to more extensive pumping to allow determination of the subsequent effect of pumping on distribution of potentially impingeable fish.

2.0 METHODS

The study area, shown in Figure 2-1, extended from Douglas Pt in the north to Gunn Pt in the south, and utilized sampling transects and locations from the pre-operational studies. Field sampling extended from April to December. Table 2-1 gives a comprehensive sampling schedule.

2.1 Physical and Chemical Characteristics

Continuous monitoring of water temperature was carried out by Hydraulic Studies and Development Department at three locations from April 7 to December 5, 1983 (Figure 2-1). Five thermographs (TH-B02 to 06) at 2, 5, 8, 12 and 18 m depths were located in 18 m of water approximately 1 km northwest of the Bruce GS 'B' discharge. The remaining locations were sampled with single thermographs: TH-B08-3 400 m north of Bruce GS 'B' discharge channel at 2.5 m in 3 m of water; TH-B17-7.5 at Gunn Pt at 7 m in 7.5 m of water. A current meter (CM-05-08) was located approximately 1.6 km off Douglas Pt at 8 m in 25 m of water.

Water samples for chemical analysis were collected seasonally at the following locations: Bruce GS 'B' intake transect, 12 m depth contour, surface and bottom; Bruce GS 'B' discharge transect, 3 m and 7 m surface. Temperature and dissolved oxygen profiles and Secchi depth were obtained where water samples were taken. Samples were collected by Van Dorn Bottle, treated and stored appropriately and returned to the Analytical Services Section, Chemical Research Department, for analysis. Parameters determined are listed in Table 2-2.

2.2 Adult and Juvenile Fish Distribution and Biology

Adult and juvenile fish were collected from nearshore waters by gill nets, and from shallow inshore waters by beach seine. The gill netting effort was the same as that in the year III (1981) preoperational study, except for the deletion of the McRae Point transect. Experimental gill nets, consisting of nine 15.2 m panels of 2.5 cm (1 inch) to 12.7 cm (5 inch) mesh, were set on the bottom perpendicular to shore from the 3 and 12 m depth contours. Nets were fished for two consecutive 24 h periods monthly from May to December. Five transects were fished: Douglas Pt, Bruce GS 'B' discharge, Bruce GS 'B' intake, Holmes Bay and Gunn Point. Exceptions to the above program were limited to the following: 2.5 cm mesh was unavailable for 3 and

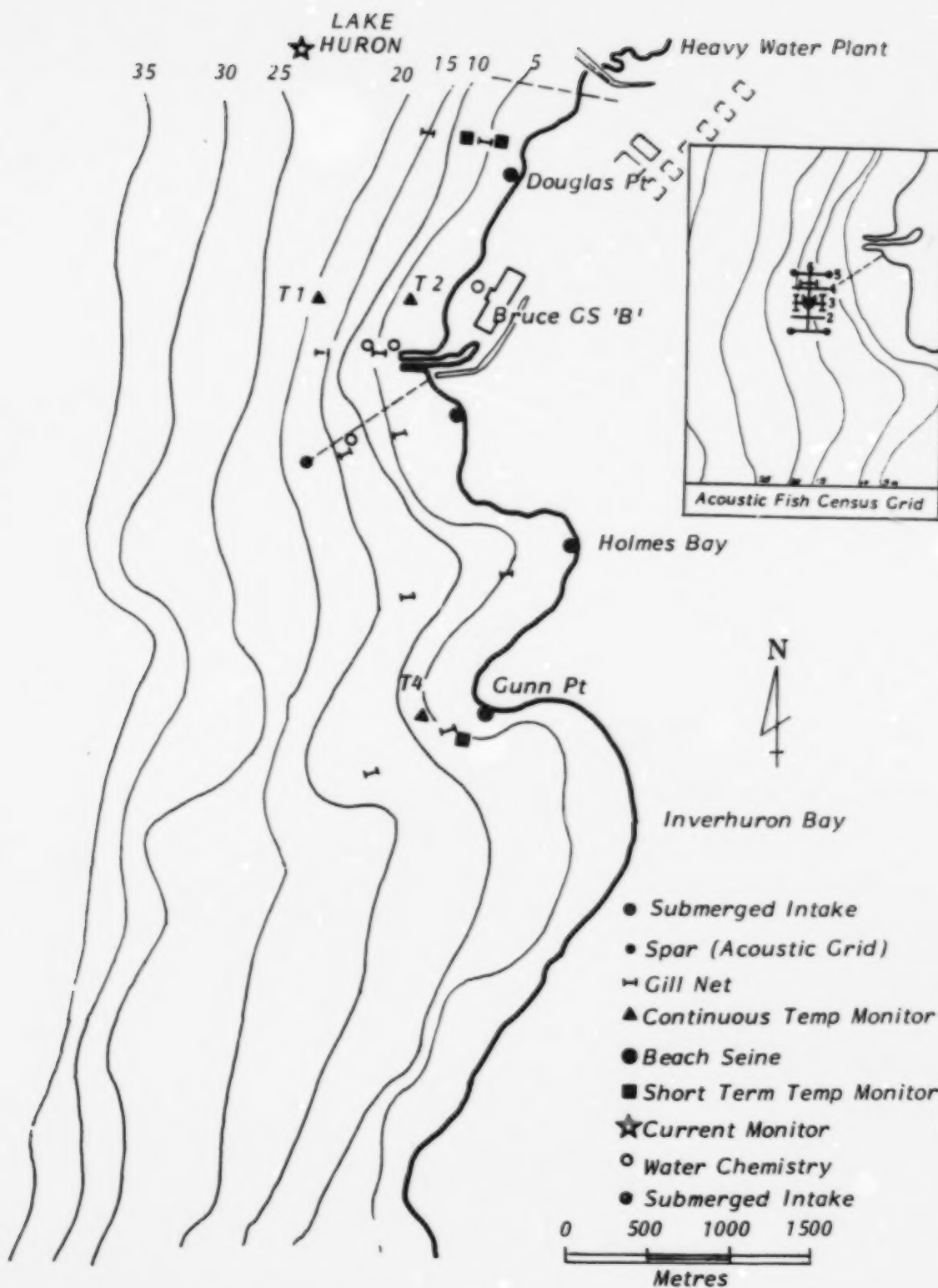


FIGURE 2-1
AQUATIC SAMPLING LOCATIONS AT BRUCE G.S. 'B', 1983

TABLE 2-1

SAMPLING SCHEDULE, BRUCE GS 'B', 1983

Parameter	Month											
	April	May	June	July	Aug	Sept	Oct	Nov	Dec			
Temperature and Current Monitors	x											x
Water Chemistry			x			x				x		
Fish:												
Gill Nets		x	x	x	x	x	x	x				x
Beach Seines		x	x	x	x							
Acoustic Census - Day			xx		xx							
- Night					xx							
Temperature Monitor at Gill Nets		x				x					x	

TABLE 2-2

WATER CHEMISTRY PARAMETERS, BRUCE GS 'B', 1983

Colour	Sodium - mg/L
Conductivity - mS/m	Non-filtrable Residues (Dissolved
Turbidity - ntu	Solids) 105 and 550°C - mg/L
pH	Filtrable Residues (Suspended
Total Phosphorus - ug/L	Solids) 105 and 550°C - mg/L
Soluble Phosphorus - ug/L	Hardness - mg/L as CaCO ₃
Orthophosphorus - ug/L	Alkalinity mg/L as CaCO ₃
Magnesium - mg/L	Kjeldahl Nitrogen - mg/L
Total Silica - mg/L	Soluble Nitrogen - mg/L
Calcium - mg/L	Total Nitrogen - mg/L*
Aluminum - mg/L	Nitrate Nitrogen - mg/L
Potassium - mg/L	Nitrite Nitrogen - mg/L
Dissolved Iron - mg/L	Ammonia - mg/L
	Sulphate - mg/L
	Chloride - mg/L

* calculated value: Total N = Kjeldahl N + Nitrate N + Nitrite N

12 m nets at Gunn Pt on June 22 and the Douglas Pt 12 m net on July 13. Due to severe weather, duration of the second net set was 48 hours in October and 72 hours in November at all locations.

Length, weight and scale samples were obtained from all trout, salmon, whitefish, walleye and smallmouth bass, with the exception of some partially decomposed fish collected in July, August and November. Reproductive condition and sex of all round whitefish were noted, and a representative subsample of 100 round whitefish was aged.

Water temperatures were obtained at the inshore and offshore ends of each gill net, at surface, bottom and 2 m above bottom at setting and retrieval. In addition, three thermographs were installed to provide continuous temperature records during the May, August and November netting periods at the following locations: Douglas Pt 3 m net, inshore and offshore ends; Gunn Pt 3 m net, inshore end. November data for the offshore end of the Douglas Pt 3 m net were lost with the meter.

Beach seine hauls were made in triplicate after dusk, using a 15 m (50 ft) seine with 0.63 cm (1/4 inch) mesh. Douglas Pt, Bruce GS 'B' intake, Holmes Bay and Gunn Pt transects were sampled monthly from May to August. Catches were preserved in formalin and returned to the laboratory for identification. Juveniles and young-of-the-year were separated from adults.

2.3 Acoustic Observations of Fish

Acoustic surveys of fish populations were carried out in a grid of transects surrounding and passing over the submerged intake of Bruce GS 'B' (Figure 2-1). Six surveys were conducted in summer: two day surveys in July and two consecutive day and night surveys in August. Echo data were collected using the high resolution acoustic system and survey methods employed in preoperational surveys (eg. OHRD Report No 83-451-K).

Identification of acoustically observed fish species was from experimental gill nets set in the grid (Figure 2-1) for 2 - 3 h following the surveys. Inferences on species composition were also made from monthly netting survey catches, which were carried out in the same week (July) or in the week prior to the acoustic surveys (August). Temperature profiles were obtained

at the inshore and offshore ends of the median transect and in the intake depression during August. Although no profiles were obtained in July, temperatures were obtained at the inshore and offshore ends of the Bruce GS 'B' intake transect 12 m net within several hours of each acoustic survey.

3.0 RESULTS

3.1 Water Temperature and Currents

Daily mean temperatures from the 3 m depth northwest of the discharge (TH-B08-3), and the 2 and 12 m depths at the 18 m contour off Bruce GS 'B' (TH-B02-2 and TH-B06-12) are presented in Figure 3-1. The 3 m inshore and 12 m offshore locations are considered to approximate the thermal regimes of the Bruce GS 'B' discharge transect 3 m and 12 m gill net locations (inshore ends). Daily mean temperatures at the 7.5 m depth, Gunn Pt (TH-B17-7.5) should be indicative of the thermal regime at the Gunn Pt 3 m gill net location, offshore end; mean daily temperatures are given in Appendix 1.

Water temperatures at 3 m inshore and 2 and 12 m offshore were approximately 5°C at the end of April, peaked at 22 - 23°C in early August and declined again to 5°C by the end of November (Figure 3-2). Extreme fluctuations in temperature were apparent from June through September. These are attributed to wind-driven mass water movements including upwellings, downwellings and external and internal seiches (waves). Major events are illustrated in Figure 3-2 (A and B). For four three-day periods hourly temperature fluctuations at the three locations shown in Figure 3-1 are shown in Figure 3-2.B and corresponding changes in vertical temperature curves at eight hour intervals at the 18 m depth contour are shown in Figure 3-2.A. In an attempt to correlate large-amplitude nearshore temperature changes with inshore-offshore water movements, hourly currents at the 8 m depth at CM-05-08 are also shown with inshore (S to NNE) and offshore (N-SSW) directional components separated (bottom of Figure 3-2.B). Among these examples, August 9 - 11 and 20 - 22 contain strong short-term fluctuations not apparent from daily mean temperature records. On August 9 temperatures at 12 - 18 m fell much more rapidly over the first 12 - 16 h than did near-surface temperatures. This resulted in a marked, though unstable vertical temperature gradient which persisted for approximately 48 h until isothermal low temperature conditions were established. During the period of the unstable gradient,

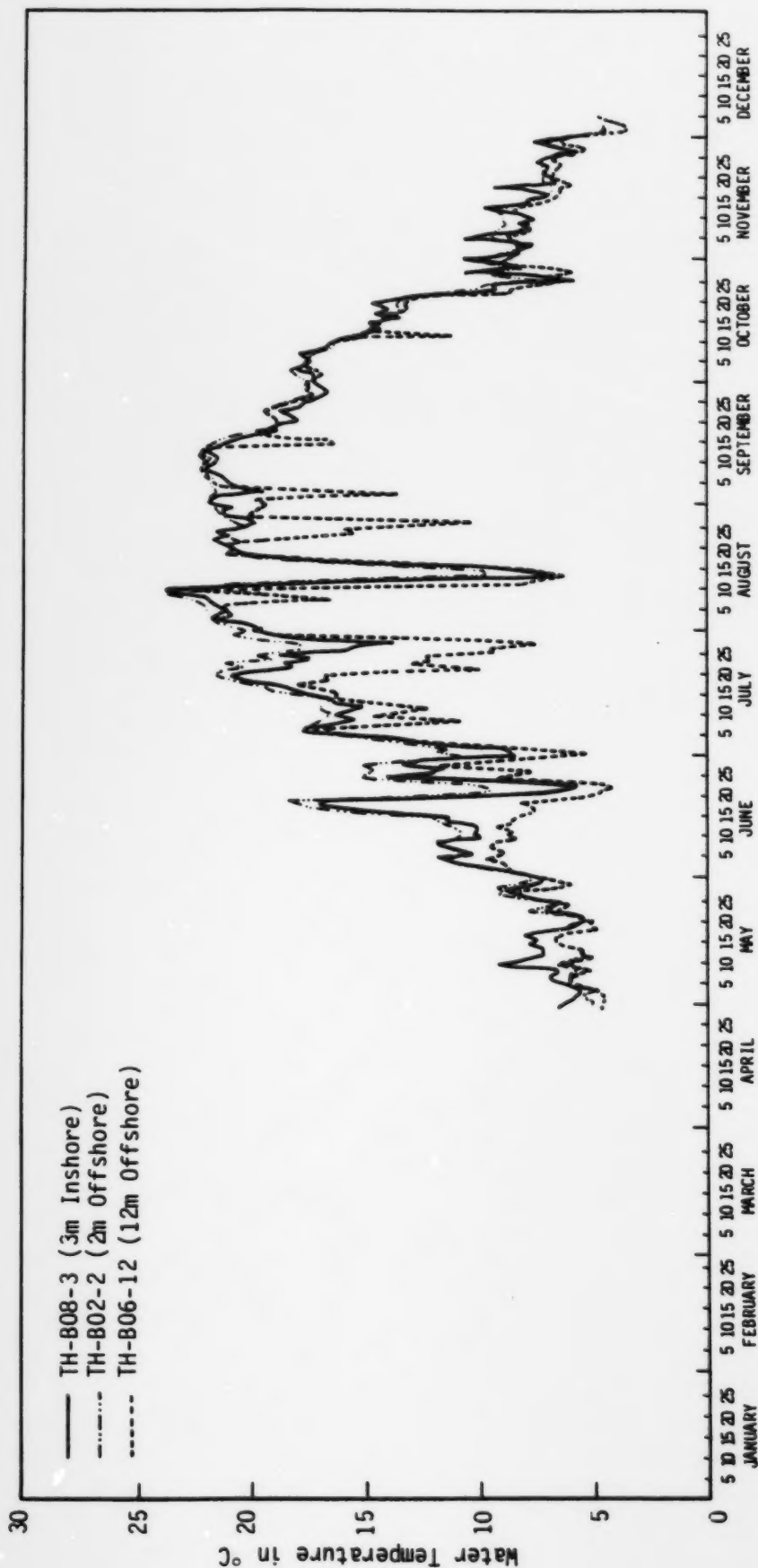


FIGURE 3-1
DAILY MEAN WATER TEMPERATURE AT THREE LOCATIONS
BRUCE G.S. 'B', 1983

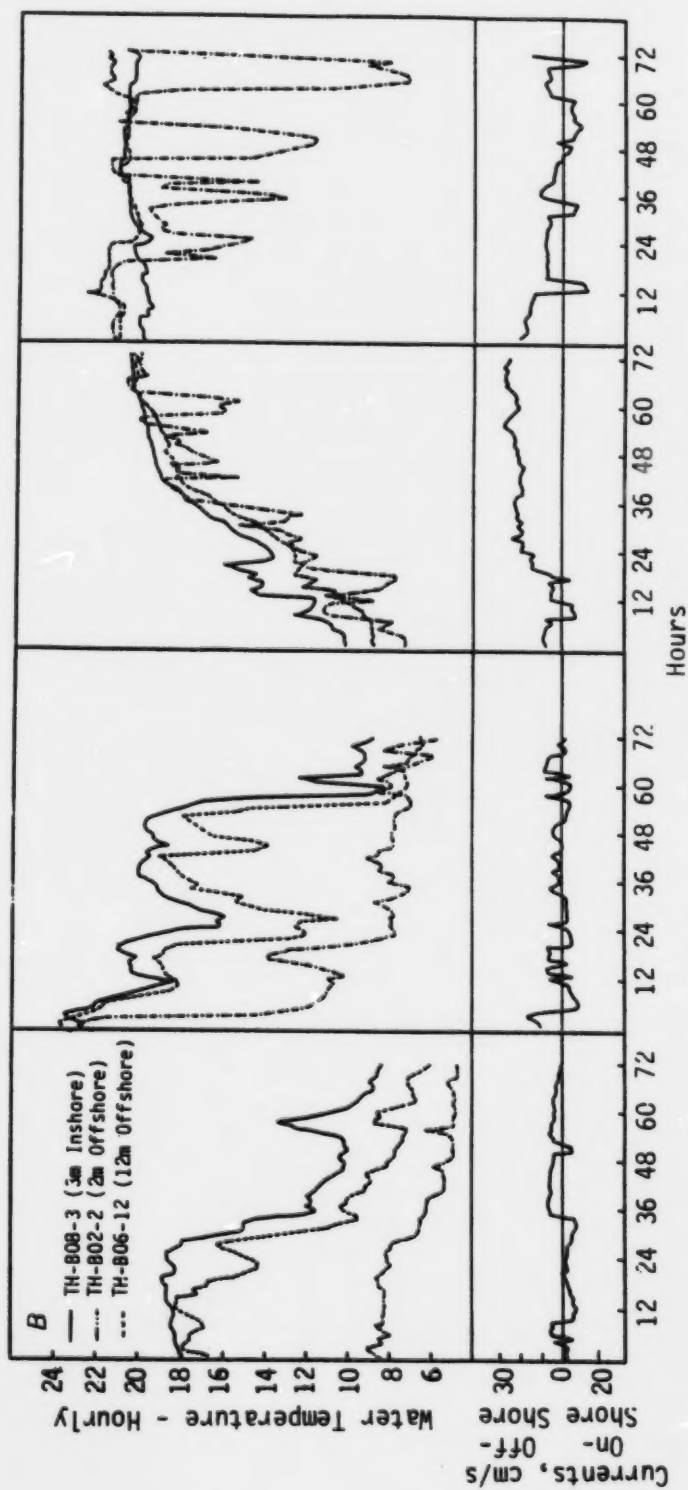
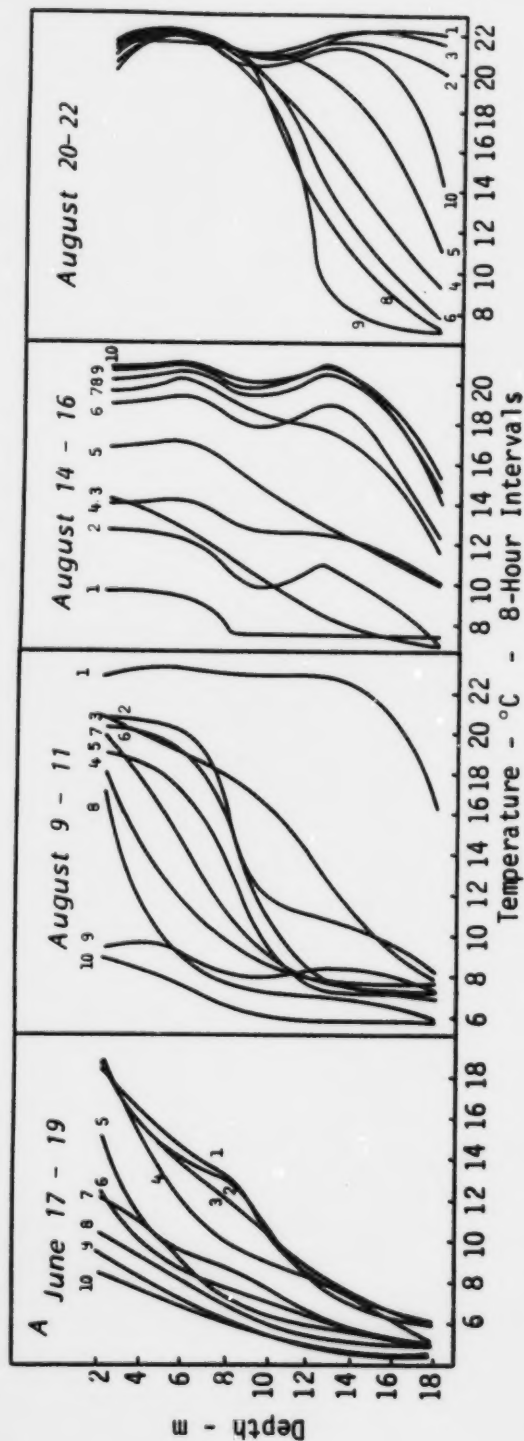


FIGURE 3-2

RAPID LARGE-AMPLITUDE CHANGES IN THERMAL REGIME OFF BRUCE G.S. 'B' DURING FOUR 72-hr PERIODS IN 1983

A: TEMPERATURE PROFILES AT THE 12m DEPTH CONTOUR, IN 10 8-hr INTERVALS

B: CURRENT PROFILES AT THREE LOCATIONS AND CURRENT SPEED AT CM-05

the inshore temperature did not decline smoothly, but with large fluctuations, the peaks of which were 12 - 24 h apart. Beginning late on August 20, strong sub-surface temperature oscillations, attributable to internal seiches, were observed from 12 m to bottom. These had a periodicity of 12 - 15 h (trough to trough), and became progressively greater in amplitude, the fourth encompassing 21 to 7°C at the 12 m depth. During this period several shifts in inshore-offshore current direction were observed at CM-05 (8 m depth, 2 km north of the vertical temperature meter array); these could not, however, be correlated with temperature changes.

Hourly readings of current direction and velocity (m/s) at CM-05-8 for the above 24 h periods and for the days covering gill netting were selected for inclusion in Appendix 2. Currents during these periods were generally in an alongshore direction, with both northerly and southerly currents persistent in several cases. Currents generally ranged from 3 to 20 cm/s. Maximum velocity observed during the selected periods was 29 cm/s (NW, Aug 16), while maximum velocity for the entire year was 36 cm/s (ENE, October 10). Complete frequency analysis of current direction and velocity will be provided in a Geotechnical and Hydraulic Engineering Department Report.

3.2 Water Chemistry

In 1983 analyses for 29 parameters were performed seasonally during the open water period. Table 3-1 shows results summarized by date and year, and compared with ranges of yearly values from preoperational surveys. Complete 1983 results by sample are listed in Appendix 3. Temperature profiles and Secchi depths obtained at the time of sampling are given in Appendix 4.

Values for most parameters were similar to those observed during the preoperational period. Non-volatile filtrable residues were somewhat lower in 1983 than in preoperational years, due largely to exceptionally low values for June samples. In the case of nutrients, notable exceptions were observed for soluble silica (higher in 1983) and various forms of nitrogen (lower in 1983). As analytical procedures have improved, the precision of reporting has changed, with, in some cases, decreases in detection limits by an order of magnitude. A thorough review of the impact of such changes is required before the significance of year-to-year changes in these chemical nutrient values can be addressed.

TABLE 3-1

WATER CHEMISTRY: DATE & YEARLY MEANS
BRUCE GS 'B', 1983

Parameter	June 23	August 25	October 25	1983	1979-1981 Range
pH	8.08	8.25	7.95	8.09	7.9 - 8.3
Colour	none	none	none	none	none
Conductivity (ms/m)	21	20.8	21	20.9	18.8 - 20.5
Turbidity (NTU)	0.448	1.343	1.08	0.96	0.67 - 1.20
Alkalinity (mgCaCO ₃ /L)	79.3	78	79	78.8	78.1*
Non-Filtrable Residues (mg/L)					
105°C (Volatile)	124	162	126	137.2	118 - 125
550°C (Non-Volatile)	43.5	89.5	80.5	71.2	96 - 99
Filtrable Residues (mg/L)					
105°C (Volatile)	<1	1.5	<2	<1.5	1.03 - <1.82
550°C (Non-Volatile)	<1	<1	<2	<1.33	0.5 - <1.27
Total Phosphorus (µg/L)	10.8	6.5	10.3	9.2	<9.1**
Soluble Phosphorus (µg/L)	10.5	<2	4.3	5.7	<6.2**
Orthophosphate (µg/L)	5.8	<2	<2.3	3.37	<6.7**
Total Silica (mg/L)	1.4	1.4	2.0	1.58	1.26 - 1.46
Soluble Silica (mg/L)	1.3	1.3	2.0	1.532	0.8 - 1.03
Total Kjeldahl Nitrogen (mgN/L)	0.215	0.168	0.208	0.197	0.34 - 0.43
Soluble Nitrogen (mgN/L)	0.16	0.15	0.13	0.144	0.14 - 0.26
Nitrite Nitrogen (mgN/L)	0.088	<0.01	<0.003	<0.033	<0.01 - <1.2
Nitrate Nitrogen (mgN/L)	0.57	0.28	0.29	0.379	1.1 - 1.3
Ammonia (mgN/L)	<0.015	<0.018	<0.01	<0.14	0.01 - <0.045
Total Nitrogen (mgN/L) ¹	0.873	0.453	0.500	0.609	<1.65 - <2.8
Calcium (mg/L)	29.18	28.05	27.00	28.077	25.3 - 26.5
Aluminum (mg/L)	<0.5	<1	<0.5	<0.67	<4.0*
Potassium (mg/L)	0.955	1.023	0.868	0.9486	0.92*
Dissolved Iron (mg/L)	<0.05	<0.05	<0.05	<0.05	<0.5*
Sodium (mg/L)	3.35	3.09	3.20	3.21	3.48*
Sulphate (mg/L)	15.3	16.3	16.8	16.13	15.3*
Chloride (mg/L)	5.28	5.30	5.48	5.353	-
Magnesium (mg/L)	7.3	7.3	7.5	7.32	7.0 - 7.1
Hardness (mgCaCO ₃ /L)	103.3	99.3	98.3	100.3	91.8*

1979 only

* 1981 only

Total N = Kjeldhal + Nitrite & Nitrate N

<n = below detection limit of n

3.3 Adult and Juvenile Fish Distribution and Abundance

In 1983 the nearshore fish community was sampled by gill nets and beach seines. The combined catch consisted of approximately 12 000 fish of 45 species (Table 3-2). Overall fish abundance appeared to be similar to that in 1979 and 1981; the deletion of trap netting and of the McRae Pt transect, together with normal year-to-year variation can account for the somewhat lower total catch. The number of species was also similar to that observed during the pre-operational years of 1979 to 1981. Species not previously reported from the Bruce GS 'B' study area included lamprey (probably sea lamprey), lake whitefish, white perch, sauger, two new minnows and one new darter. All except white perch were reported to occur in Lake Huron or its tributary streams by Scott and Crossman (1973). The white perch is common in the lower Great Lakes and is now expanding its range into Lake Huron, based on reports from the Ministry of Natural Resources.

As in previous years, the catch was dominated by alewife (36%), a pelagic clupeid which occurs in the nearshore waters of the Great Lakes in large numbers in spring and early summer. Other species contributing 5% or more to the total catch included longnose sucker (11%), longnose dace (11%), yellow perch (7%), spottail shiner (7%), white sucker (6%), and gizzard shad (6%). The contribution of round whitefish to the catch increased from 1.3% in the pre-operational period.

In examining the distribution of the catch in individual gear types, gill net catches in 2.5 cm meshes were kept separate from those in the larger, more consistently fished meshes to facilitate year-to-year comparison. The temporal distribution of CUE (catch-per-unit-effort) for major species in 3.8 - 12.7 cm mesh gill nets is shown in Table 3-3. The only common species which peaked in abundance (both depths combined) in early spring was burbot. Peak catches of alewife and longnose sucker, occurred in July, while those of yellow perch, white sucker, round whitefish and walleye occurred in September. Only gizzard shad were most commonly caught in late fall. Over the year, yellow perch and burbot catches were substantially greater in deep (12 m) sets, while most gizzard shad were caught in shallow (3 m) sets. Shallow and deep catches of the remaining major species did not vary greatly. However, there was evidence of a shift from shallow to deep distribution for alewife and longnose sucker in summer, and from deep to shallow for round whitefish in fall. Similar trends had been apparent during the preoperational period.

TABLE 3-2
COMPOSITION OF FISH CATCH IN ALL GEAR TYPES
BRUCE GS 'B', 1983

Species		1983		1979-1981
Common Name and Family	Scientific Name	No	%	%
Lamprey (unid.) (Petromyzontidae)		2	<0.1	-
Lake Sturgeon (Acipenseridae)	<i>Acipenser fulvescens</i>			<0.1
Longnose Gar (Lepisosteidae)	<i>Lepisosteus osseus</i>			<0.1
Alewife (Clupeidae)	<i>Alosa pseudoharengus</i>	4 344	36.0	26.3 - 62.6
Gizzard Shad	<i>Dorosoma cepedianum</i>	729	6.0	0.8 - 5.0
Pink Salmon (Salmonidae)	<i>Oncorhynchus gorbuscha</i>	2	<0.1	<0.1
Coho Salmon	<i>Oncorhynchus kisutch</i>	1	<0.1	<0.1
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	4	<0.1	<0.1
Cisco	<i>Coregonus artedii</i>	1	<0.1	<0.1
Lake Whitefish	<i>Coregonus clupeaformis</i>	1	<0.1	<0.1
Round Whitefish	<i>Prosopium cylindraceum</i>	385	3.2	0.8 - 2.1
Rainbow Trout	<i>Salmo gairdneri</i>	16	0.1	<0.1 - 0.1
Brown Trout	<i>Salmo trutta</i>	1	<0.1	<0.1
Lake Trout	<i>Salvelinus namaycush</i>			<0.1
Splake	<i>S. namaycush</i> x <i>S. alpinus</i>	2	<0.1	<0.1
Rainbow Smelt (Osmeridae)	<i>Osmerus mordax</i>	194	1.6	0.4 - 6.7
Northern Pike (Esocidae)	<i>Esox lucius</i>	1	<0.1	<0.1
Redbelly Dace (Cyprinidae)	<i>Chrosomus eos</i>			<0.1
Longnose Dace	<i>Rhinichthys cataractae</i>	1 318	10.9	0.2 - 0.8
Fathead Minnow	<i>Pimephales promelas</i>	1	<0.1	-
Lake Chub	<i>Couesius plumbeus</i>	439	3.6	3.4 - 7.1
Creek Chub	<i>Semotilus atromaculatus</i>			<0.1
Carp	<i>Cyprinus carpio</i>	10	<0.1	<0.1
Golden Shiner	<i>Notemigonus crysoleucas</i>			<0.1
Emerald Shiner	<i>Notropis atherinoides</i>	12	0.1	0.2 - 0.5
Common Shiner	<i>Notropis cornutus</i>	1	<0.1	<0.1
Rosyface Shiner	<i>Notropis rubellus</i>			<0.1
Spottail Shiner	<i>Notropis hudsonius</i>	810	6.7	5.0 - 27.9
Mimic Shiner	<i>Notropis volucellus</i>			<0.1
Sand Shiner	<i>Notropis stramineus</i>	3	<0.1	-
Bluntnose Minnow		4	<0.1	0.1 - 0.2
Cyprinidae (unid.)	<i>Pimephales notatus</i>	49	0.4	<0.1 - 0.4
Longnose Sucker (Catostomidae)	<i>Catostomus catostomus</i>	1 347	11.2	7.7 - 13.2
White Sucker	<i>Catostomus commersoni</i>	778	6.4	5.9 - 9.5
Golden Redhorse	<i>Moxostoma erythrum</i>			0 - 0.2
Shorthead Redhorse	<i>Moxostoma macrolepidotum</i>			0 - 0.2
Redhorse (unid.)		47	0.4	0 - 0.2
Brown Bullhead (Ictaluridae)	<i>Ictalurus nebulosus</i>	1	<0.1	<0.1
Channel Catfish	<i>Ictalurus punctatus</i>	69	0.6	<0.1 - 0.4
Stone Cat	<i>Moxostoma flavigum</i>			<0.1
Burbot (Gadidae)	<i>Lota lota</i>	317	2.6	0.3 - 0.8
Brook Stickleback (Gasterosteidae)	<i>Culaea inornata</i>			<0.1
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	2	<0.1	<0.1
Ninespine Stickleback	<i>Pungitius pungitius</i>			<0.1
Trout-Perch (Percopsidae)	<i>Percoopsis omiscomaycus</i>	28	0.2	<0.1 - 0.3
White Bass (Percichthyidae)	<i>Morone chrysops</i>	22	0.2	<0.1 - 0.1
White Perch	<i>Morone americana</i>	2	<0.1	-
Rock Bass (Centrarchidae)	<i>Ambloplites rupestris</i>	5	<0.1	<0.1
Smallmouth Bass	<i>Micropterus dolomieu</i>	46	0.4	0.1 - 0.2
Pumpkinseed	<i>Lepomis gibbosus</i>			<0.1
Black Crappie	<i>Pomoxis nigromaculatus</i>			<0.1
Fantail Darter (Percidae)	<i>Etheostoma flabellare</i>			<0.1
Rainbow Darter	<i>Etheostoma caeruleum</i>	1	<0.1	-
Johnny Darter	<i>Etheostoma nigrum</i>	28	0.2	<0.1
Yellow Perch	<i>Perca flavescens</i>	901	7.5	3.5 - 11.7
Logperch	<i>Perca caprodes</i>	1	<0.1	<0.1
Walleye	<i>Stizostedion vitreum</i>	111	0.9	0.1 - 0.5
Seager	<i>Stizostedion canadense</i>	1	<0.1	-
Freshwater Drum (Sciaenidae)	<i>Aplodinotus grunniens</i>	13	0.1	<0.1
Mottled Sculpin (Cottidae)	<i>Cottus bairdi</i>	13	0.1	<0.1
Slimy Sculpin	<i>Cottus cognatus</i>	16	0.1	<0.1
TOTAL CATCH		12 079		14 013 - 25 360 (mean)
No of Species (excluding unid.)		45		35 - 48 (mean)

TABLE 3-3

CATCH PER UNIT EFFORT OF MAJOR FISH SPECIES
IN 3.8 - 12.7 cm MESH GILL NETS BY MONTH AND DEPTH

Species	CUE								May-Nov	
	May 17,18	June 21,22	July 13,14	Aug 30,31	Sept 28,29	Oct 25,27	Nov 15,18	Dec 13,14	CUE	%
3 m:									29.3	52
Alewife	29.6	5.6	206.8	5.5	1.2				6.0	11
Longnose Sucker	12.2	9.5	17.5	2.8	2.3	3.2	0.8	0.2	2.9	5
Yellow Perch	0.2	1.1	5.5	17.1	0.2	0.3			4.7	8
White Sucker	4.3	1.5	8.2	5.3	7.5	5.8	2.4	1.5	6.8	12
Gizzard Shad			0.2	11.6	5.6	9.9	12.9	2.0	3.0	5
Round Whitefish	1.5	1.0	0.1		4.4	4.3	4.3	4.3	1.4	3
Burbot	5.4	0.8			0.1	0.7	1.0	2.5	0.8	1
Walleye			0.2	1.5	1.6	0.7	1.3	0.3	1.9	3
Others	1.9	1.3	1.5	6.8	3.6	3.1	1.3	0.2		
Total CUE	55.1	20.8	240.0	50.6	26.5	28.0	24.0	10.6	56.8	
12 m:									18.8	42
Alewife	4.3	2.1	78.3	74.6	0.3				7.9	17
Longnose Sucker	5.9	2.8	24.3	15.9	5.4	10.7	3.8	3.3	7.5	17
Yellow Perch	0.6	10.4	4.6	9.3	37.2	0.8	0.3	0.2	3.6	8
White Sucker	0.1		1.5	2.7	13.3	4.0	3.5	3.5	1.5	3
Gizzard Shad				0.4	3.1	2.3	2.8	0.2	1.4	3
Round Whitefish	1.1	0.6	0.4	0.1	5.6	0.7	1.5	0.5	2.1	5
Burbot	7.2	1.4	0.7	0.1		2.7	2.1	2.1	0.5	1
Walleye				0.1	2.6	0.2	0.5		2.0	4
Others	0.1		1.4	0.4	1.5	0.8	1.3	0.7		
Total CUE	19.3	17.3	111.2	103.6	60.0	22.2	15.8	10.5	45.3	
3 + 12 m:									24.1	47
Alewife	17.0	3.9	142.6	40.1	0.8				7.0	14
Longnose Sucker	9.1	6.2	20.9	9.4	3.9	7.0	2.3	1.8	5.2	10
Yellow Perch	0.4	5.8	5.0	13.2	18.7	0.5	0.2	0.1	4.2	8
White Sucker	2.2	0.8	4.9	4.0	10.4	4.9	2.9	2.5	4.1	8
Gizzard Shad			0.1	5.5	4.4	6.1	7.8	1.1	2.2	4
Round Whitefish	1.3	0.8	0.3	0.1	5.0	2.5	2.9	2.2	1.8	4
Burbot	6.3	1.1	0.4	0.1	0.1	1.7	1.5	2.3	0.7	1
Walleye			0.1	0.8	2.1	0.4	0.9	0.2	1.8	4
Others	0.9	0.5	1.3	4.4	2.4	2.0	1.4	0.4		
TOTAL CUE	37.2	19.1	175.6	77.1	47.8	25.1	19.9	10.6	51.1	
No of Species	12	7	15	17	18	17	17	12	31	
No of 24 h sets	20	20	20	20	20	30	40	20	170	

Gill nets of 2.5 cm mesh were fished consistently in 1973. These were selective for small forage fish, including juvenile alewife and adult lake chub, spottail shiner and rainbow smelt. Catch-per-unit-effort of spottail shiner and lake chub peaked in July, while largest numbers of adult rainbow smelt and juvenile alewife were caught in August (Table 3-4). Spottail shiners were taken in much greater numbers in shallow sets, while rainbow smelt were virtually confined to deep sets. Over the year, CUE of juvenile alewife and smelt was similar in shallow and deep sets, but there was evidence of a shift from shallow to deep water from June to July (lake chub) or July to August (alewife).

Beach seine catches were dominated by longnose dace, spottail shiner and rainbow smelt (Table 3-5). Longnose dace, a minnow which is common on wave-washed shores of large lakes (Gee and Machniak, 1972) appeared to be more abundant than in pre-operational years, while alewife, which were previously caught in large numbers as young-of-the-year, contributed only 2% of the catch. Catches of longnose dace and spottail shiner peaked in August, when the majority were juveniles (Table 3-6). Almost all of the rainbow smelt taken in May were also juveniles.

Alongshore variation in CUE of 8 major species in 3.8 - 12.7 cm mesh gill nets is shown in Table 3-7. No strong north-south trends were apparent. Temperature data collected in association with netting are shown in Appendix 6.

3.4 Biology of Selected Fish Species

Round whitefish: The majority of fish caught were adults aged 3 - 6 years and 340 - 420 mm in fork length (Figure 3-3). No strong seasonal trends in age, length or sex composition were observed, although most of the comparatively small number of individuals which were less than 300 mm in length were caught from May to September. Fish collected during or near the reproductive period (Oct 25 - Dec 14) included approximately equal numbers of males and females with mean fork length of 386 mm and weight of 687 g (Table 3-8). Spent whitefish were first observed on the mid-December sampling trip, when approximately 90% were in post-spawn condition.

TABLE 3-4

CATCH PER UNIT EFFORT OF MAJOR FISH SPECIES
IN 2.5 cm MESH GILL NETS BY MONTH AND DEPTH

Species	CUE								May-Nov	
	May 17,18	June 21,22	July 13,14	Aug 30,31	Sept 28,29	Oct 25,27	Nov 15,18	Dec 13,14	CUE	%
3 m:										
Spottail Shiner	7.8	1.5	16.5	1.5	0.5	0.1	0.2		3.1	45
Lake Chub	1.8	3.5	10.0	0.7	0.8		0.3	0.1	1.9	28
Alewife	1.5	0.3	4.4	3.1		1.8			1.4	21
Rainbow Smelt	0.2		0.2			0.1	<0.1	0.2	0.1	2
Others	0.6	0.1	1.7	0.3	0.3	0.1	<0.1		0.3	4
Total CUE	11.9	5.4	32.8	5.6	1.6	2.1	0.5	0.3	6.8	
12 m:										
Spottail Shiner	1.0		3.4	0.8	1.3	0.3	0.6	0.1	1.0	17
Lake Chub	0.2	0.1	11.3	3.3	0.7	0.1	0.4	0.2	1.9	32
Alewife	0.3	0.8	1.3	8.9		0.1			1.3	22
Rainbow Smelt	0.2	0.3	0.3	9.8			<0.1	0.2	1.2	20
Others	0.4	0.8	2.4	0.1	0.2	0.1	<0.1		0.5	
Total CUE	2.1	2.0	18.7	22.9	2.2	0.5	1.0	0.5	5.9	
3 + 12 m:										
Spottail Shiner	4.4	0.8	9.6	1.2	0.9	0.2	0.4	0.1	2.1	33
Lake Chub	1.0	1.9	10.7	2.0	0.8	<0.1	0.3	0.2	1.9	30
Alewife	0.9	0.5	2.8	6.0		0.9			1.4	22
Rainbow Smelt	0.2	0.1	0.3	4.9		0.1	<0.1	0.2	0.7	11
Others	0.5	0.6	2.0	0.2	0.5	0.1	<0.1		0.3	4
TOTAL CUE	7.0	3.9	25.4	14.3	2.2	1.3	0.7	0.4	6.4	
No of Species	5	6	10	7	6	6	4	3	13	
No of 24 h sets	20	18	19	20	20	30	40	20	170	

TABLE 3-5

CATCH-PER-UNIT-EFFORT OF MAJOR FISH SPECIES IN BEACH SEINES

Species	CUE				May-August	
	May 18	June 22	July 12	August 23	CUE	%
Longnose dace	26.8	32.6	15.8	37.1	28.6	63
Spottail shiner	4.5	7.4	8.4	19.6	10.0	22
Rainbow smelt	6.2				1.6	4
Unid. cyprinidae		0.1	4.7	0.1	1.1	2
Lake chub	0.4	0.2		2.5	0.8	2
Alewife	2.6	0.2			0.7	2
Johnny darter	0.3	1.9	0.1		0.6	1
White sucker	0.3	1.0	0.1		0.4	1
Other	2.0	1.4	2.0	0.7	1.7	4
Total CUE	43.1	44.8	31.1	60.8	45.5	
No of Species*	11	14	10	9	21	
No of Hauls	12	12	10	12	46	

*excluding unidentified

TABLE 3-6
PERCENTAGE OF JUVENILES IN BEACH SEINE CATCHES

Species	May 18	June 22	July 12	August 23	Year
Longnose dace	27.0	0.3	0	68.1	29.7
Spottail shiner	5.5	7.9	0	95.7	50.8
Rainbow smelt	97.2				97.2
Unid. cyprinidae			100	100*	100
Lake chub	0	0*		100	83.8
Alewife	48.4	50*			48.5
Johnny darter		78.3	100*		75.0
White sucker	100	100	50*		94.4
Slimy sculpin	0	0	100	0*	37.5
Mottled sculpin	16.6	0*	0*	0*	7.7
Emerald Shiner	22.2	100*			41.7
Smallmouth bass		0*	0*	100	66.7

*1-3 individuals in sample

TABLE 3-7

ALONGSHORE VARIATION IN CATCH-PER-UNIT EFFORT OF
MAJOR FISH SPECIES IN 3.8 - 12.7 cm MESH GILL NETS

Species	Transect				
	Douglas Point	Bruce GS 'B' Discharge	Bruce GS 'B' Intake	Holmes Bay	Gunn Point
Alewife	29.2	16.4	26.5	15.1	20.1
Longnose Sucker	8.5	6.4	7.2	3.7	9.0
Yellow Perch	5.0	7.6	2.6	3.7	4.5
White Sucker	4.2	2.6	3.3	4.6	5.2
Gizzard Shad	3.1	3.6	3.3	6.5	2.6
Round Whitefish	2.1	1.8	1.7	2.2	2.3
Burbot	1.4	1.1	1.3	1.6	2.8
Walleye	0.8	0.9	0.6	0.1	0.5

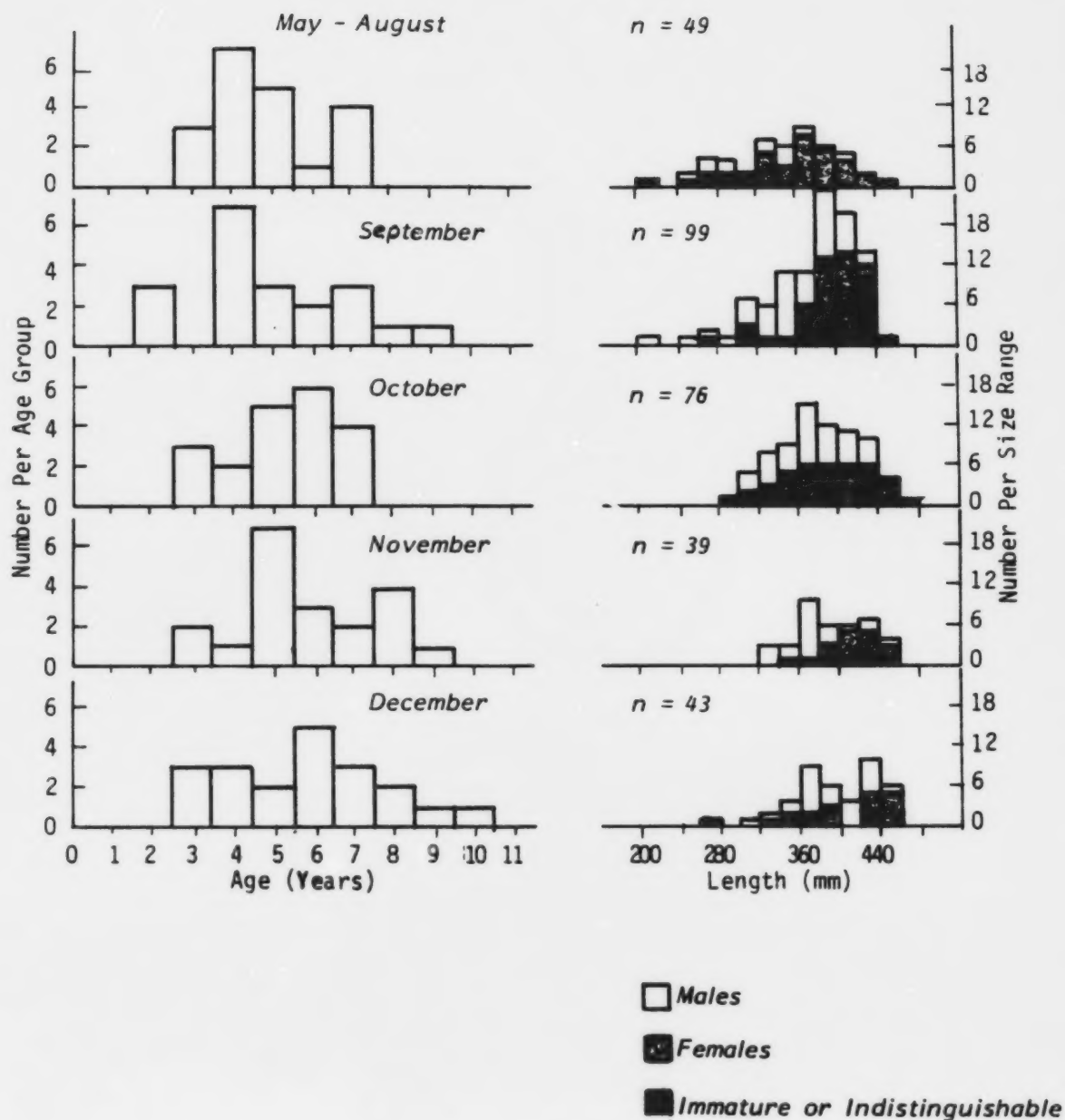


FIGURE 3-3
 SEASONAL AGE, LENGTH AND SEX DISTRIBUTION OF
 ROUND WHITEFISH AT BRUCE G.S. 'B', 1983

TABLE 3-8

BIOLOGICAL CHARACTERISTICS OF ROUND WHITEFISH CAUGHT
DURING THEIR REPRODUCTIVE PERIOD, OCTOBER - DECEMBER, 1983

Dates	Oct 25-27		Nov 15-18		Dec 13-14		Total
Depth of Set	3 m	12 m	3 m	12 m	3 m	12 m	
Total Examined	66	10	33	6	39	4	158
Mean Fork Length - mm	378	379	395	392	389	432	386
Mean Weight - g	669	705	722	688	667	870	687
Total Aged	20	0	19	1*	18	2	60
Mean Age - years +	5.3	-	6.1	3.0 (345mm)	5.6	8.0	5.6
% by Sex:							
Female	48	50	45	50	36	50	45
Male	50	20	52	50	46	50	48
Immature or Indistinguishable	2	30	3		18		7
% of Mature Fish in Post-Spawn Condition							
Females	0	0	0	0	93	100	21
Males	0	0	0	0	89	100	24

*Samples for aging selected by month, but not by depth.

Walleye: The length distribution of walleye taken in gill nets is shown in Figure 3-4. Over 90% of fish were over 400 mm fork length, indicating that only adult walleye utilized nearshore waters in the Bruce GS 'B' study area to a significant degree. Scarcity of small walleye was also noted in pre-operational surveys. As in 1981, we captured a tagged walleye which had been released in the mouth of the Thames River during a spawning run in the previous spring.

Meristic data and scales of game fish including walleye, small-mouth bass, salmon and trout are being accumulated for analysis and aging over the four commissioning study years. These data will be presented and discussed in the year IV and final report.

3.5 Acoustic Observations of Fish in the Vicinity of the Submerged Intake

Acoustic surveys were conducted in summer by day (4 samples) and night (2 samples). The grid, which included two transects intersecting on the intake cap, was designed to show fish distribution in the area of the intake depression in finer detail than available from preoperational acoustic surveys. The distribution of pelagic and demersal fish concentrations was mapped from the analogue records (echograms), as shown in Figure 3-5. Pelagic fish schools extending 2 - 4 m from bottom were distributed throughout the sample grid in July day samples, and to a lesser extent in August day samples. In August night samples a diffuse layer of midwater fish echoes was observed at a depth of 5 - 9 m. Demersal fish were scattered throughout the survey grid in all samples, but rarely occurred in sizable aggregations (Figure 3-5).

There was an apparent tendency for pelagic schools to be clustered in the vicinity of the intake depression in some, but not all day samples. Large schools were observed at the edge of the intake depression on July 14 and August 24 (day samples). Small aggregations were observed within the depression on August 23 (night) and August 24 (day). However, there was no evidence that pelagic or demersal fish favoured the intake depression itself. The depth of the midwater layer of fish observed at night did not change over the intake cap. Examples of the position of fish in relation to the intake cap and depression during day and night surveys are shown in Figure 3-6.

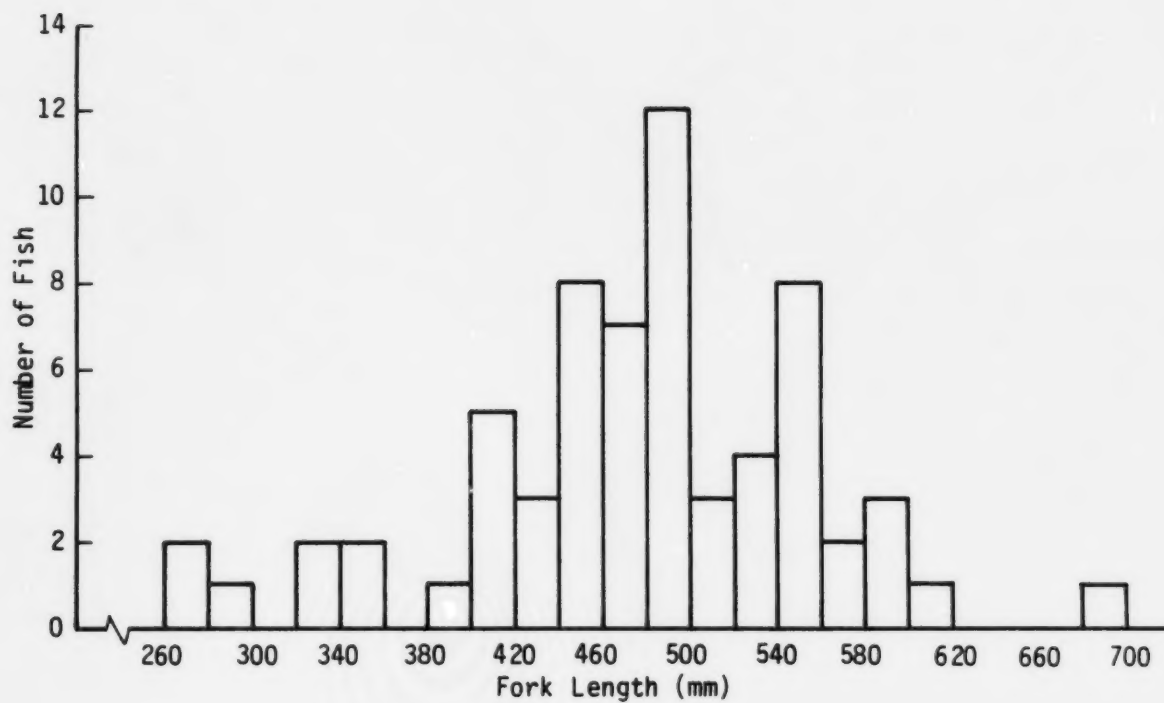
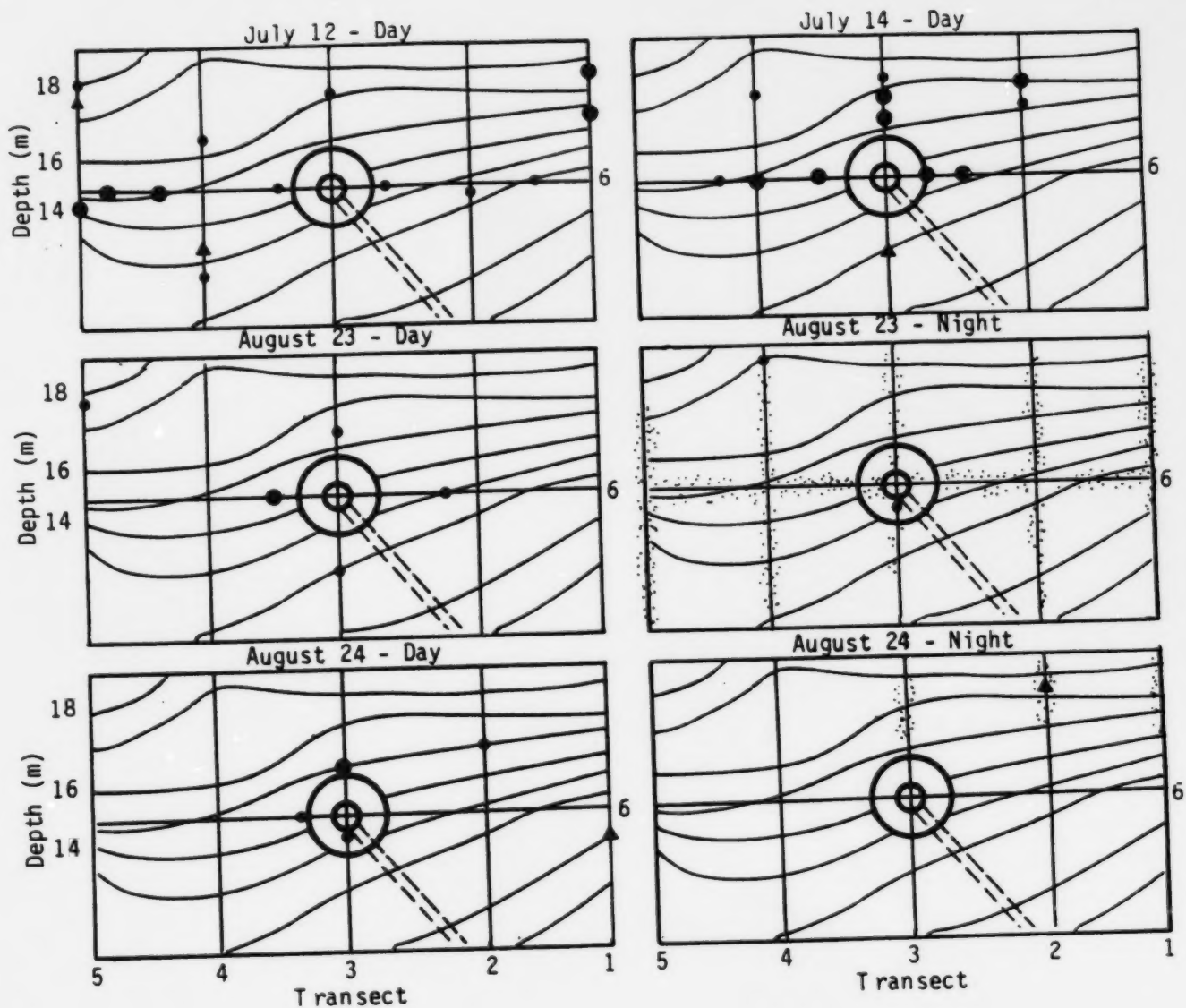


FIGURE 3-4
LENGTH DISTRIBUTION OF WALLEYE
CAUGHT AT BRUCE G.S. 'B', 1983



Pelagic Schools - Large

- Small

Demersal Aggregations - Small

Diffuse Midwater Layer

FIGURE 3-5
DISTRIBUTION OF ACOUSTICALLY OBSERVED FISH AGGREGATIONS
IN THE VICINITY OF THE BRUCE G.S. 'B' INTAKE, 1983

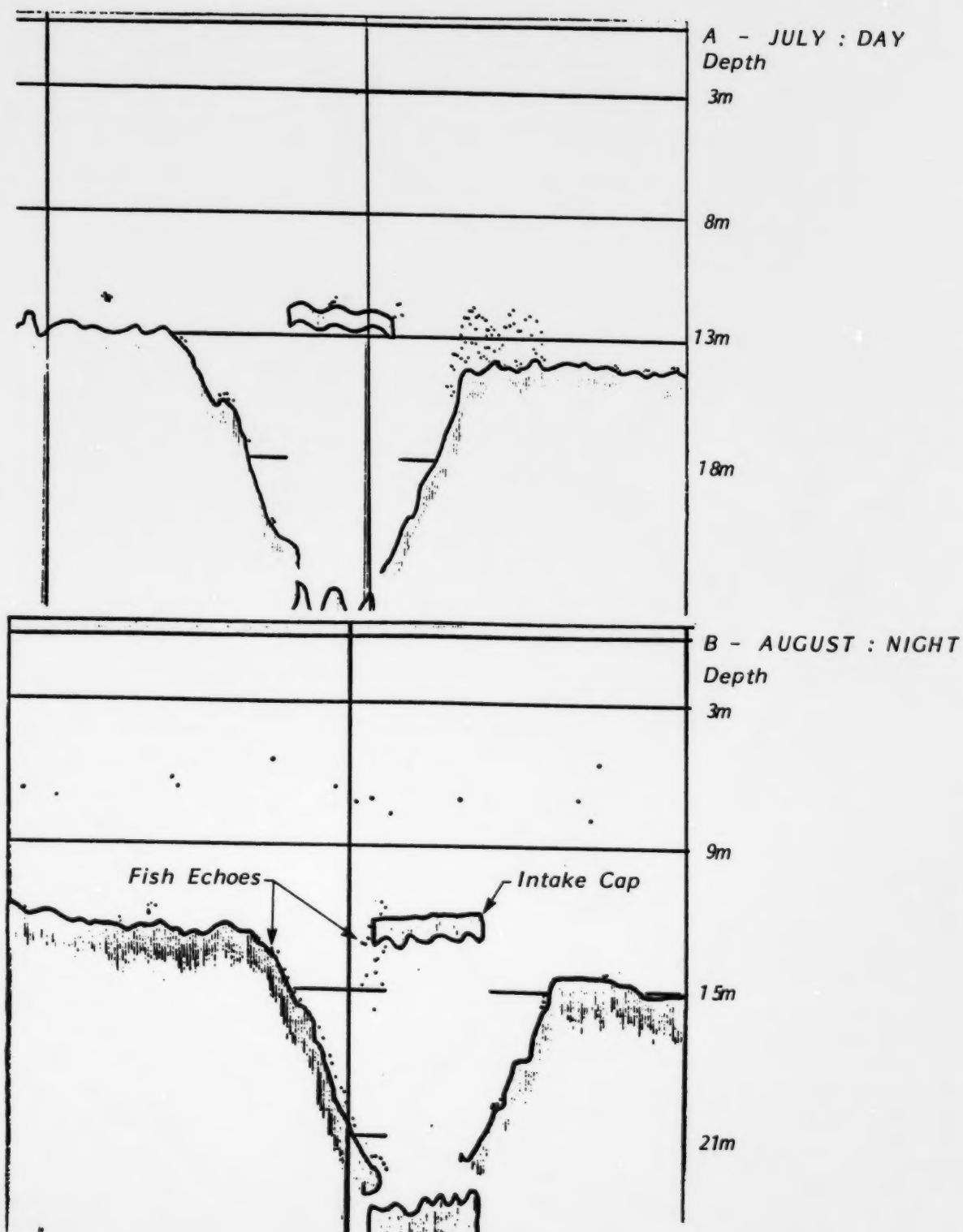


FIGURE 3-6
REPRESENTATIVE ECHOGRAMS SHOWING THE DISTRIBUTION OF
FISH ECHOES AT THE INTAKE DEPRESSION:
A: TRANSECT 6, JULY 12, DAY: B; TRANSECT 3, AUGUST 23, NIGHT

Temperature profiles (Appendix 8) obtained at the intake depression on August 23 and 24 (without pumping) suggested that the area below lake bottom was subject to temperature fluctuations similar to those seen at the offshore 18 m monitor, and was unlikely to have special significance as a refuge for cold-water fish species.

Short-term gill netting carried out in conjunction with acoustic surveys produced primarily alewife by day and lake chub and suckers by night (Appendix 9). A single round whitefish was caught at night at the 18 m depth in August. It can be inferred that alewife contributed the bulk of fish schools observed near bottom by day, and dispersed to form the midwater layer at night. Most demersal fish were probably suckers and chub.

4.0 SUMMARY

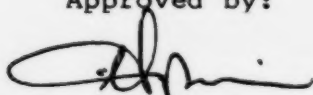
1. Nearshore water temperatures rose from approximately 5°C at the end of April to a maximum of 22-23°C in early August, declining again to 5°C by the end of November. Extreme temperature fluctuations occurred from June through August. These were the result of mass water movements which either took the form of internal seiches, affecting only the deeper strata or, more commonly, were upwelling or downwelling events which affected the entire water column. Such events are typical of exposed nearshore environments of the Great Lakes.
2. Water quality parameters were generally similar to those observed during the pre-operational period (1979-81). Exceptions included the nutrients silica (higher in 1983) and various forms of nitrogen (lower in 1983).
3. Adult and juvenile fish abundance and community composition were similar to those observed in pre-operational netting. Alewife dominated the catch, followed by longnose sucker, longnose dace, yellow perch, spottail shiner, white sucker and gizzard shad. The relative catches of round whitefish, longnose dace and burbot were substantially higher than those during the pre-operational period. Age 0 alewife, which formerly made up a large proportion of summer beach seine catches, were not taken in 1983 sampling.

4. The majority of round whitefish were adults greater than 300 mm in fork length caught from September to December. Post-spawn whitefish were first taken in mid-December, when they made up 90% of the catch.
5. Results of acoustic surveys in the vicinity of the submerged intake prior to commencement of test pumping suggested that in some cases pelagic fish schools, presumed to be alewife, were clustered in the vicinity of the intake depression. There was no evidence that either pelagic or demersal fish favoured the intake depression itself, although scattered individuals and in two cases small aggregations were recorded within it.

ACKNOWLEDGEMENT

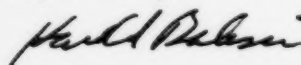
Larry King, Biological Research Section carried out field work and assisted in report preparation.

Approved by:



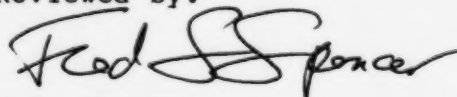
O.A. Kupcis
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REFERENCES

- Gee, J.H. and K. Machniak. 1972. Ecological notes on a lake-dwelling population of longnose dace (*Rhinichthys cataractae*). J. Fish. Res. Board Can. 29:330-332.
- Ontario Hydro Research Division Report No 83-451-K.
Bruce GS 'B' preoperational biological study. year III, 1981.
H. Balesic, Dec 30, 1983.
- Ontario Hydro Research Division Report, Draft. Bruce GS 'B' preoperational biological studies. Summary, 1979 to 1983.
H. Balesic and I.D. Martin.
- Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fish. Res. Board Can. Bull. 184. 966 p.

APPENDIX 1

MEAN DAILY TEMPERATURES AT GUNN POINT, 7.5 m DEPTH (TH-817-7.5)

Month	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
April								2.9	3.1	3.2	3.8	4.0	4.1	3.9	4.5	4.1	5.0	5.3	4.2	5.7	3.9	4.3	4.5	4.6	6.1	5.9	5.7	5.4	5.4	5.3	
May						6.5	6.9	6.3										5.3	5.7	6.4	7.7	7.1	6.8	7.7	9.5	9.6	8.7	7.0	8.0	8.5	9.3
June	10.6	11.7	11.3	10.4	11.1	11.2	11.2	9.4	10.0	9.8	9.9	10.1	10.8	10.4	11.5	13.8	14.0	6.4	4.8	4.7	4.7	5.2	9.6	9.2	9.4	11.4	11.6	7.4	5.8	8.3	
July	12.7	13.9	15.7	17.4	17.3	14.1	14.0	16.6	15.4	14.1	15.3	16.7	17.2	18.1	19.2	19.8	20.6	20.4	16.6	12.7	15.4	14.4	15.9	13.7	12.2	8.6	11.6	19.7	19.6	0.0	21.1
August	22.0	21.2	21.5	22.0	21.7	21.6	22.3	23.2	15.4	9.3	6.3	5.8	7.8	12.0	18.0	20.6	21.1	21.1	21.6	21.7	20.1	18.6	16.7	13.6	13.8	20.1	21.0	20.0	20.4	1.2	19.6
September	16.2	20.9	21.6	21.9	22.1	22.3	21.8	21.8	22.1	22.2	21.8	21.6	20.7	20.1	20.1	19.8	18.9	18.3	18.6	19.3	19.1	17.9	17.5	17.3	16.7	17.0	17.3	17.2	17.4	7.1	
October	16.7	17.8	17.9	17.7	17.3	17.0	16.8	16.2	15.2	13.8	14.7	14.4	14.0	12.5	12.9	13.2	12.8	12.8	12.4	10.5	8.0	7.3	5.6	4.3	5.7	6.4	6.9	7.5	8.5	8.0	7.8
November	7.6	7.4	8.6	9.2	7.0	6.8	7.1	7.7	7.7	8.2	8.7	6.9	6.6	6.2	5.7	6.7	5.4	5.7	5.5	6.3	6.0	5.6	6.0	5.8	4.4	4.2	6.1	5.8	4.8	2.4	
December	2.2	2.3	4.0	4.9	4.9																										

APPENDIX 2

CURRENT DIRECTION AND VELOCITY (cm/s)
AT CM-05, 1.6 km OFF DOUGLAS POINT ON SELECTED DATES IN 1983

Month	May (Fishing)			June (Temperature Decline, Fishing)					
Date	16	17	18	17	18	19	20	21	22
HOUR									
1	SSW 8	NNE 3	- 0	ENE 2	ESE 2	WNW 4	- 0	WSW 1	SW 4
2	SSE 7	NNE 3	ESE 2	ENE 1	SE 3	W 4	WSW 2	- 0	SW 4
3	SSE 8	NE 3	ESE 2	NNE 2	SSE 2	S 4	W 2	- 0	SW 4
4	SW 10	NNE 4	E 3	SSW 4	E 3	S 4	WNW 1	WSW 1	WSW 4
5	S 7	NNE 3	ESE 3	S 4	ENE 5	SW 4	- 0	WSW 2	WSW 4
6	SSE 7	NE 3	E 5	SW 5	ENE 5	SW 4	NW 1	WSW 2	W 5
7	SSE 8	NE 3	E 5	WSW 6	ENE 5	SW 6	- 0	W 1	SW 8
8	E 8	NE 3	E 5	WSW 5	ENE 6	SW 5	- 0	WSW 2	SSW 5
9	SE 8	SE 2	ESE 3	SW 5	ENE 6	SW 4	- 0	W 2	SW 5
10	E 7	SE 2	SSE 4	SSW 5	NE 5	SW 4	- 0	W 1	SW 6
11	E 7	SE 2	SSE 4	E 5	SW 6	SW 4	- 0	- 0	WSW 5
12	ENE 6	ESE 2	SSE 4	ENE 6	SW 7	WSW 4	NW 2	- 0	WSW 4
13	E 7	SE 3	SSE 4	NE 6	SW 7	SW 4	NW 5	- 0	WNW 3
14	ENE 7	SSE 2	SSE 3	NE 5	SW 6	SW 4	W 3	WSW 2	W 2
15	NE 5	SSE 2	SSE 3	NE 5	SW 6	SW 4	SW 2	WSW 5	NW 3
16	NE 6	SSE 2	S 3	ENE 3	SW 6	SW 4	W 2	SW 3	NE 3
17	ENE 7	SSE 2	SSW 3	ENE 3	SW 5	WSW 3	W 2	SW 3	NNE 2
18	ESE 6	SE 2	SSW 2	ENE 2	SW 6	W 2	W 2	SSW 2	E 3
19	SE 9	SE 1	SW 3	ENE 2	SW 6	WNW 2	WSW 2	SSW 4	ESE 6
20	SSW 8	SE 1	SW 2	E 1	SW 6	WNW 2	WSW 2	SSW 4	WSE 5
21	W 8	- 0	- 0	- 0	WSW 6	NW 1	SSW 2	SW 4	WSW 8
22	S 5	SE 1	- 0	SE 2	W 6	NW 1	SW 1	SW 3	WSW 6
23	NNW 4	E 1	WNW 2	ESE 2	WSW 5	- 0	W 1	SW 4	WSW 6
24	NNE 3	SE 1	W 3	SE 1	WS 4	- 0	W 1	SW 4	WSW 6

APPENDIX 2 (cont'd)

Month	July (Fishing)						August (Temperature Decline, Fishing)					
Date	12	13	14	9	10	11	14	15	16			
HOURL												
1	NE 26	NE 7	NNE 3	W 9	S 4	WSW 4	NNW 8	NW 19	NW 22			
2	NE 26	ENE 7	NE 3	WSW 12	NNW 4	W 3	NW 9	NW 19	NW 24			
3	NE 25	NE 6	NE 3	W 16	NNE 4	WSW 3	NNW 9	NW 25	NW 23			
4	NE 25	NNE 6	NNE 3	SW 11	NNE 4	S 4	NNW 8	NW 20	NW 23			
5	NE 24	- 3	- 0	SSE 8	ESE 4	ESE 4	NNW 7	WNW 19	NW 24			
6	NE 25	NNE 3	NNE 3	SE 9	NE 4	SSE 4	WNW 4	WNW 21	NW 25			
7	NE 23	NNE 3	NNE 3	S 8	NE 4	SSE 5	WNW 8	NW 19	NW 29			
8	NE 20	NE 3	NE 3	S 7	NE 4	SE 5	SSE 7	WNW 22	NW 28			
9	NE 17	NE 3	NE 3	S 6	SSE 3	S 5	SE 6	WNW 21	NW 26			
10	NE 15	NE 3	NE 3	S 5	SSW 3	SW 7	SE 5	WNW 22	NW 24			
11	NE 15	NE 4	NE 3	ESE 5	W 4	S 4	E 5	WNW 23	NW 22			
12	NE 13	NE 4	NE 4	SW 5	- 0	S 5	SW 5	WNW 23	NW 21			
13	NE 12	NNE 4	NE 3	SE 6	- 0	S 5	WNW 6	WNW 23	NW 23			
14	NE 11	NE 4	NE 3	WNW 6	- 0	SSW 6	WNW 5	NW 19	NW 22			
15	NE 11	NE 4	NE 4	SSW 6	N 3	S 5	WSW 4	NW 19	NW 23			
16	NE 12	NE 4	SSE 4	S 4	- 0	SW 7	NW 6	NW 20	NW 25			
17	NE 13	NE 4	NNE 5	WNW 5	- 0	SW 7	S 4	NW 21	NW 28			
18	NE 13	NE 4	NNE 4	W 5	- 0	WSW 6	NW 5	NW 21	NW 27			
19	ENE 12	NE 3	NNE 4	W 4	NW 3	WNN 5	NW 9	NW 21	NW 28			
20	ENE 12	NE 4	NE 5	WSW 5	- 6	W 4	NW 15	NW 20	NW 28			
21	ENE 10	NE 3	NE 7	ENE 5	- 0	ENE 3	NW 14	NW 18	NW 27			
22	NE 9	NNE 3	NE 8	NE 6	- 0	E 3	NW 16	NW 21	NW 29			
23	ENE 7	NNE 3	NE 9	S 6	- 0	- 0	NNW 13	NW 20	NW 27			
24	NE 6	NE 3	NE 13	ENE 5	WSW 3	SE 3	NW 20	NW 22	NW 26			

APPENDIX 2 (cont'd)

Month	August (Temperature Changes)				September (Fishing)				
Date	20	21	22	29	30	31	27	28	29
<u>HOUR</u>									
1	NNW 20	SW 8	S 5	SSW 3	S 5	NE 8	ESE 10	S 4	SE 3
2	NNW 17	SW 8	SSW 4	- 0	SSW 6	NE 6	E 10	SSW 5	S 6
3	NNW 17	SW 8	S 5	- 0	W 6	ENE 7	ESE 10	SSW 3	E 8
4	NNW 17	SW 8	SE 6	SSE 4	WSW 6	ENE 8	ESE 10	SSW 3	SE 6
5	NNW 18	SW 7	ESE 7	SSE 5	WSW 7	NE 7	ESE 9	SW 3	SE 7
6	NNW 16	SSW 6	ESE 9	SSE 3	SE 6	ENE 9	E 8	- 0	SE 8
7	NNW 15	SSW 7	ESE 8	- 3	S 6	E 8	E 9	SSW 3	SE 7
8	NNW 15	S 5	ESE 5	- 0	SSE 6	ENE 8	E 8	- 0	SE 8
9	NNW 15	S 6	ESE 6	- 0	S 4	E 9	ESE 8	SSW 3	SSE 11
10	NW 14	S 7	ESE 5	- 0	WSW 4	E 8	ESE 8	SSW 3	SSE 10
11	NW 13	SSW 10	ESE 4	- 0	SSE 5	ENE 9	E 8	- 0	SSE 9
12	WSW 13	SSW 11	SE 4	- 0	SW 4	ENE 8	SE 8	SSW 3	S 9
13	ESE 12	SSW 10	S 6	- 0	SSW 6	E 9	SSE 7	- -	S 10
14	ESE 11	SW 7	SSW 6	S 0	SW 5	E 8	S 7	S 4	S 8
15	SSE 10	SW 4	SWS 7	ESE 3	SSW 4	E 8	S 6	S 5	SSW 8
16	SSW 8	SW 5	SW 8	ESE 5	SE 7	W 8	SW 7	S 6	SSW 8
17	WSW 7	SW 4	SW 9	ESE 5	SSE 6	S 7	SW 6	S 7	SSW 7
18	W 7	SSW 4	SSW 6	ESE 5	E 7	ESE 8	SW 6	S 8	SSW 4
19	W 8	SSW 3	SSW 6	S 4	ESE 9	SE 8	SSW 6	S 9	S 4
20	WNW 7	SSW 3	SSW 7	S 4	E 8	SE 8	SSW 5	S 8	S 4
21	W 8	- 0	SSW 8	S 5	ENE 6	SE 8	SSW 6	S 7	S 4
22	W 7	- 0	S 8	S 5	ENE 7	SW 7	SSW 6	SSE 5	S 3
23	W 8	SSE 3	S 12	SE 6	ENE 6	WSW 8	SSW 6	SSW 3	SSW 3
24	SW 8	SSE 4	SSW 15	S 5	NE 7	WSW 7	S 4	SE 4	SSW 3

APPENDIX 3

WATER QUALITY ANALYSES, BRUCE GS 'B', 1983

Date	Location	June 23				August 25				October 27			
		A	B	C	D	A	B	C	D	A	B	C	D
pH		8.1	8.1	8.1	8.0	8.3	8.3	8.3	8.1	8.0	7.9	7.9	8.0
Colour		none	none	none	none	none	none	none	none	none	none	none	none
Conductivity (uS/m)		21	21	21	21	20.7	20.8	20.8	21.0	21	21	21	21
Turbidity (NTU)		0.41	0.42	0.42	0.34	0.70	0.79	0.98	2.9	1.0	1.0	1.0	1.1
Alkalinity (mg CaCO ₃ /L)		79	80	79	79	78	78	78	78	79	79	79	79
Dissolved Solids (mg/L)		130	120	118	126	162	162	144	180	130	124	130	120
105°C		48	40	34	52	88	88	78	104	88	82	74	78
Suspended Solids (mg/L)													
550°C		1	1	<1	1	1	1	1	3	2	<2	<2	<2
105°C		<1	<1	<1	1	<1	1	<1	1	<2	<2	<2	<2
Total Phosphorus (ug/L)		<5	16	5	15	<2	5	6	13	14	13	9	5
Soluble Phosphorus (ug/L)		<5	10	17*	10	<2	<2	2	2	5	4	5	3
Orthophosphate (ug/L)		<2	10	5	6	<2	<2	<2	<2	<2	2	3	<2
Total Silica (ug/L)		1.3	1.3	1.4	1.4	1.3	1.3	1.3	1.7	2.16	2.18	1.97	2.03
Soluble Silica (ug/L)		1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	2.06	1.95	1.88	1.97
Total Kjeldahl Nitrogen (mg N/L)		0.16	0.19	0.18	0.33	0.13	0.15	0.15	0.24	0.20	0.20	0.19	0.24
Nitrite Nitrogen (mg N/L)		0.08	0.09	0.09	0.09	<0.01	<0.01	<0.01	<0.01	<0.003	<0.003	<0.003	<0.003
Nitrate Nitrogen (mg N/L)		0.30	1.28	0.38	0.32	0.24	0.25	0.28	0.33	0.25	0.36	0.27	0.29
Total Nitrogen (mg N/L)		0.34	1.56	0.65	0.74	0.38	0.41	0.44	0.58	0.45	0.56	0.46	0.83
Calcium (mg/L)		28.4	30.5	28.7	29.1	29.0	26.4	27.9	28.9	27	27	27	27
Aluminum (mg/L)		<0.5	<0.5	<0.5	<0.5	<1	<1	<1	<1	<0.5	<0.5	<0.5	<0.5
Potassium (mg/L)		0.95	0.96	0.95	0.96	0.97	0.99	1.0	1.13	0.88	0.85	0.87	0.87
Dissolved Iron (mg/L)		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sodium (mg/L)		3.35	3.34	3.35	3.35	3.0	3.0	3.1	3.2	3.2	3.2	3.2	3.2
Sulphate (mg/L) ^a		15.4	14.9	15.4	15.5	17	16	16	16	17	17	17	16
Chloride (mg/L)		5.2	5.2	5.4	5.3	5.3	5.3	5.4	5.2	5.5	5.5	5.5	5.4
Magnesium (mg/L)		7.3	7.3	7.3	7.3	7.2	7.1	7.2	7.2	7.7	7.3	7.5	7.4
Hardness (mg CaCO ₃ /L)		102	106	102	103	102	95	99	101	99	97	99	98

* - possible contamination ** - calculated values.

Locations: Discharge Transect, Surface, 3 m Contour - A
Intake Transect, Surface, 12 m - Contour - C
" " Bottom, 12 m - Contour - D

APPENDIX 4
SECCHI DEPTHS AND TEMPERATURE PROFILES TAKEN DURING
WATER QUALITY SAMPLING

Date	June 23			August 25			October 27		
Location* Secchi Depth - m Temperature - °C	A 2 m	B 3 m	C 3 m	A 3 m	B 7 m	C 10 m	A 1.8 m	B 2.0 m	C 2.5 m
Surface	15.5	15.5	15.5	20.3	20.6	20.6	10.5	10.6	9.3
1 m	15.5	15.5	15.5	20.2	20.6	20.6	10.3	10.6	9.3
2	15.5	15.5	15.5	20.0	20.5	20.6	8.0	8.0	9.2
3	15.5	15.5	15.5	18.0	20.5	20.6	6.4	6.0	8.8
4	15.5	15.5	15.5	14.4	20.3	20.6	6.4	6.0	8.5
5	15.5	15.5	15.5		20.2	20.6		6.0	8.0
6		15.5	15.5		19.8	20.3		6.0	7.7
7		15.5	15.5		19.5	20.1		6.0	7.5
8			15.5			19.8			7.4
9			15.5			19.6			7.4
10			15.5			13.8			7.3
11			15.5			11.7			7.1
12			15.5			9.8			7.1
13			15.5			8.0			
14									

* A Discharge Transect, 3 m contour
B Discharge Transect, 7 m contour
C Intake Transect 12 m contour

APPENDIX 5a

FISH CATCH IN GILL NETS AT BRUCE GS 'B', MAY TO DECEMBER, 1983
A: 3.8 - 12.7 cm MESH NETS

Dates	Location	Douglas Point				Bruce 'B' Discharge				Bruce 'B' Intake				Holmes Bay				Cunn Point				Total				
	Depth (m)	3		12		3		12		3		12		3		12		3		12		3	12	Overall	CUE	
	Set	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2							
May 17 4 18	Alewife	15	19	6	1	43	6	2		70	24	4	2	87	4	4	5	9	19	17	2	296	43	339	17.0	
	Longnose Sucker	20	47	15	5	4	10	2	2	4	4	9	14	11	9	2	2	3	10	5	3	122	59	181	9.1	
	White Sucker	3	4			2	1			4	2			15	7	1		3	2			43	1	44	2.2	
	Round Whitefish	1	3			2	1	2	1		3			2	3	2	3	1	2			15	11	26	1.3	
	Burbot	2	2	4	6	1	6	3	5	8	4	7	5	2	3	9	4	14	12	8	21	54	72	126	6.3	
	Lake Chub		1											7	2	1		1	3			14	1	15	0.8	
	Common Shiner														1							1	0	1	0.1	
	Northern Pike													1								1	0	1	0.1	
	Carp											1	2									1	0	1	0.1	
	Yellow Perch	1			2			1	1			1	2									2	6	8	0.4	
	Rainbow Trout							1														1	0	1	0.1	
	Splake							1														1	0	1	0.1	
May Total		42	76	25	14	52	26	10	9	86	38	22	21	124	26	19	14	32	49	31	28	551	193	744	37.2 n=20	
June 21 6 22	Alewife	7	1	1			10	3	7	12	15	3	3			1		7	4		3	56	21	77	3.9	
	Longnose Sucker	13	14	5	1	9	3	5	3	22	5		5	10	4		2	5	10		7	95	28	123	6.2	
	White Sucker	2	1			1				1				2	6					2		15	0	15	0.8	
	Round Whitefish	2	3	1	1	1	1			1	1	2	1		1		1					10	6	16	0.8	
	Burbot	5	1			1		4		1		3	2				2			1	2	8	14	22	1.1	
	Lake Chub					1								4	4			3	1			13	0	13	0.7	
June 13 6 14	Yellow Perch		1	15	11	1		38	22		1	7	3	2	3	4	2		3	1	1	11	104	115	5.8	
	June Total	29	21	22	13	14	14	50	32	37	22	15	14	18	18	6	6	15	20	2	13	208	173	381	19.1 n=20	
July 13 6 14	Alewife	186	216	237	95	259	60	66	6	354	231	105	24	168	134	59	16	429	31	96	79	2068	783	2851	142.6	
	Longnose Sucker	15	19	22	39	23	8	35	28	19	20	3	19	13	13	9	6	23	24	58	24	175	243	418	20.9	
	White Sucker	20	17	2	3	5	3	2	2	2	9		2	7	6	2	1	49	9	1		82	15	97	4.9	
	Lake Chub	2				3	1					1		2	1			2	1	2	4	10	9	19	1.0	
	Yellow Perch	9		5	4	5	1	4		3	6	3	1	9	5	4	3	11	6	14	8	55	46	101	5.0	
	Redhorse Sucker	1																				1	0	1	0.1	
	Rainbow Smelt																					0	2	2	0.1	
	Burbot			2																		0	7	7	0.4	
	Round Whitefish			1				1	1													1	4	5	0.3	
	Lake Whitefish				1			2	1									1				0	1	1	0.1	
	Channel Catfish																					1	1	2	0.1	
	Splake														1							1	0	1	0.1	
	Gizzard Shad						1								1							2	0	2	0.1	
	Walleye																					2	0	2	0.1	
	Brown Bullhead						1															0	1	1	0.1	
	Freshwater Drum							2														2	0	2	0.1	
July Total		233	252	269	143	295	76	111	38	378	267	115	46	201	159	76	28	470	69	171	115	2400	1112	3512	175.0 n=20	
Aug 30 6 31	Alewife	23	23	128	150	7	2	107	46			92	68			68	28			15	44	55	746	801	40.1	
	Longnose sucker		2	9	22	3	5	16	14	6		18	20	5		7	3	7		36	14	28	159	187	9.4	
	White Sucker	8	9	6		2	2	2	3	1	1	1	3	18	4		1	4	4	4	1	5	53	27	80	4.0
	Round Whitefish				1																	0	1	1	0.1	
	Burbot															1						0	1	1	0.1	
	Lake Chub	3												1			1					4	1	5	0.3	
	Brown Trout							1														1	0	1	0.1	
	Smallmouth Bass	3	6																			20	0	20	1.0	
	Yellow Perch	12	5		1	17	1		45	13	8		13	50	14		21	31	20		13	171	93	264	13.2	
	Walleye	7	2							1	1			2				1			1	15	1	16	0.8	
	Gizzard Shad	2	16			4	13			6	19			4	36		4	8	8			116	4	120	6.0	
	Redhorse Sucker	5	3			5	2					1		2	4			3	1			25	1	26	1.3	
	Channel Catfish	1	2									3		1				1	2			11	0	11	0.6	
	Rainbow Trout																			1		3	0	3	0.2	
	Carp		1					1						1							1	1	0	1	0.1	
	Rock Bass																					2	0	2	0.1	
	Freshwater Drum		1									1										2	0	2	0.1	
August Total		64	70	143	175	38	31	125	108	28	36	111	106	83	58	77	61	61	37	53	77	506	1036	1542	77.1 n=20	

APPENDIX 5a (Cont'd)

APPENDIX 5A (Cont'd)

Dates	Location	Douglas Point				Bruce 'B' Discharge				Bruce 'B' Intake				Holmes Bay				Gunn Point				Total				
		3		12		3		12		3		12		3		12		3		12		3	12	Overall	CUE	
		Set	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2						
Sept 28 & 29	Alewife		1														10	1			12	3	15	0.8		
	Longnose Sucker	1	1	2	10	2	5	3	6	3	2	4	8	3	2	2	3	4	11	23	54	77	3.9			
	White Sucker	9	4	13	18	2	3	15	7	6	5	10	9	14	2	13	9	16	14	19	20	133	208	10.4		
	Round Whitefish	7	1	10	3	8	2	5	6	3		6	3	3	3	5	3	8	9	12	3	44	56	100	5.0	
	Burbot																					1	0	1	0.1	
	Lake Chub																					3	7	10	0.3	
	Smallmouth Bass																					2	372	374	18.7	
	Yellow Perch																					16	26	42	2.1	
	Walleye	2	3	2	5	5	1	5	3			25	2	2	3	2	5	4	12	3	8	56	31	87	4.4	
	Gizzard Shad	1	4		6	2	2	1	4													15	1	16	0.8	
	Redhorse Sucker																					1	0	1	0.1	
	Channel Catfish																					4	2	6	0.3	
	Freshwater Drum																					3	2	5	0.3	
	Carp	1																				1	1	2	0.1	
Pink Salmon	1																				4	1	5	0.3		
Rainbow Trout																					2	0	2	0.1		
Rock Bass																					1	0	1	0.1		
Coho Salmon																					1	0	1	0.1		
September Total		22	20	29	157	25	13	39	169	19	41	28	51	27	12	31	39	45	41	43	104	265	690	955	47.8	
Oct 25 & 27	Longnose Sucker	5	4	14	22			17	11	3	5	9	34	9	2	1	12	15	4	22	19	48	161	209	7.0	
	White Sucker	2	7		5	4	6	7	7	18	12	13	8	12	1	3	10	13	1	18	87	60	147	4.9		
	Round Whitefish	3	3		1	3	3	2	7	1	2	1	8			1	9	5	3	5	2	11	41	52	2.5	
	Burbot	4		3	3	1		2	7	1	2	1										0	2	2	1.7	
	Lake Chub																					4	0	4	0.1	
	Smallmouth Bass																					4	12	16	0.5	
	Yellow Perch																					1	10	13	0.4	
	Walleye																					3	149	34	6.1	
	Gizzard Shad	1	13		16	42	17					16										17	4	21	0.1	
	Redhorse Sucker																					1	1	2	0.1	
	Channel Catfish																					3	0	3	0.1	
	Freshwater Drum																					2	0	2	0.1	
	Rainbow Trout																					17	4	21	0.7	
	Rock Bass																					1	0	1	-	
	White Bass																					1	0	1	-	
	White Perch																					1	0	1	-	
	Chinook Salmon																					1	0	1	-	
October Total		15	37	19	52	53	41	22	35	18	67	15	63	48	55	4	48	39	47	29	46	420	333	753	25.1 n=20	
Nov 15 & 18	Longnose Sucker	3		4	6	2	1	8	7	6		10	15	3		3	6					17	76	93	2.3	
	White Sucker	6		2	13	1	1	4	8	7	3	2	11	4		6	7					48	69	117	2.9	
	Round Whitefish	10	5	1	10	6	9	2	8	8		2	2	5	15	4	8	3	17	1	2	86	30	116	2.9	
	Burbot	1	4	1	10	1	1	3	2			2	8			2	2					20	41	61	1.5	
	Lake Chub	3																				4	6	10	0.3	
	Carp																					1	0	1	-	
	Yellow Perch																					1	0	6	0.2	
	Walleye	1	2	1	2	2	10	1	2	1	4			3	2		1	39	1	28		25	10	35	0.9	
	Gizzard Shad	11	36	1	9	24	17															1	258	55	313	7.8
	Redhorse Sucker																					2	0	2	0.1	
	Channel Catfish																					2	0	2	0.1	
	Rainbow Trout																					1	0	1	-	
	White Bass																					1	0	1	-	
	White Perch																					1	0	1	-	
	Lamprey																					1	0	1	-	
	Sauger																					1	0	1	-	
	Rainbow Smelt																					1	0	1	-	
November Total		35	33	10	59	35	40	15	32	34	56	18	44	69	65	15	70	10	83	12	40	480	315	795	19.9 n=40	
May-November Total		969			1130		753		795		1127		649		963		494		1018		764	4830	3852	8682	51 n=170	
Dec 13 & 14	Longnose Sucker																					2	33	35	1.8	
	White Sucker	2	2			1	1	1	10	3		2	3	1	1	2	3	3	4	2	8	15	35	50	2.5	
	Round Whitefish	3	10			3	3	1	1	5	2											39	5	44	2.2	
	Burbot	2	1			1	2	3	1	3												25	21	46	2.3	
	Lake Chub																					1	4	5	0.3	
	Yellow Perch																					0	2	2	0.1	
	Walleye																					3	0	3	0.2	
	Gizzard Shad	1	1																			0	1	1	0.1	
	Rainbow Trout																					1	0	1	0.1	
	Freshwater Drum																					0	1	1	0.1	
	Rainbow Smelt																					0	1	1	0.1	
December Total		8	14	6	4	9	13	18	9	8	4	6	10	4	9	9	5	20	17	16	22	106	105	211	10.6	
1983 TOTAL		991			1140		775		822		1139		685		976		508		1055		802	4954	3957	8893	n=20	

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APPENDIX 5

1983 FISH CATCH IN GILL NETS AT BRUCE CS 'B', 1983
B: 2.5 cm MESH

B: 2.5 cm MESH																									
Dates	Location	Douglas Point				Bruce 'B' Discharge				Bruce 'B' Intake				Holmes Bay		Gunn Point				Total					
	Depth (m)	3		12		3		12		3		12		3	12	3	12	3		12		3	12	Overall	CUE
	Set	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2				
May 17	Spottail Shiner	6		1		2	1		2	1	10		1	30	20		4	7	1	1	1	78	10	88	4.4
18	Rainbow Smelt		1								1										2	2	4	0.2	
	Alosi			1	1		1														15	3	18	0.9	
	Lake Chub												11	3			1				2	2	20	1.0	
	Trout Perch	1	2	1		1		1			2		1	3	12						18	2	20	1.0	
	Total	7	3	3	1	3	3	1	3	1	14	0	3	45	35	0	6	7	1	2	6	4	10	0.5	
June 21	Spottail Shiner	1	1							2	1			7				3	X	X	15	0	15	0.8	
22	Rainbow Smelt				1																0	2	2	0.1	
	Alosi																				3	6	9	0.5	
	Lake Chub	2	4					4	2		1					1					0	2	2	0.1	
	Trout Perch							1		4	2			12	10			2			35	1	36	2.0	
	Yellow Perch							2	2		1					4					1	5	6	0.3	
	Total	3	5	0	1	0	1	7	2	6	5	0	0	19	10	5	1	5	X	0	1	0	2	2	0.1
July 13	Spottail Shiner	5	11	X	7	18	5	6		12	15	4	5	26	16		3	21	20	3	6	149	34	183	9.6
14	Rainbow Smelt				1	1	1	1	1												2	3	5	0.3	
	Alosi	6	4			3	3	2													40	13	53	2.8	
	Lake Chub	1				28	28	14	7	4	7	28	3	7	2		3	4	6	1	3	90	113	203	10.7
	Trout Perch		1					1		1							1	1			3	3	6	0.3	
	Longnose Sucker	1						1	3												0	1	1	0.1	
	White Sucker							1													8	14	22	1.2	
	Yellow Perch																2	2	1	4	3	0	1	1	0.1
	Logperch																				2	5	7	0.4	
	Longnose Dace				1												1				3	2	5	7	0.4
	Total	13	16	X	9	50	37	26	11	18	27	39	8	51	24	0	19	29	30	23	52	295	187	482	
Aug 30	Spottail Shiner	4	6	1		1				1		2	2	1			4	2			1	15	8	23	1.2
31	Rainbow Smelt			6	8			14													0	98	98	4.9	
	Alosi	1	1		1						23	2		12	4						31	89	120	6.0	
	Lake Chub	1		1	1			14		10	28	57	1	16			3				7	33	40	2.0	
	Round Whitefish																				0	1	1	0.1	
	White Sucker			1																	1	0	1	0.1	
	Yellow Perch													1							2	0	2	0.1	
	Total	6	7	9	10	1	0	28	0	11	2	55	63	7	18	12	12	2	2	32	8	56	229	285	
Sept 28	Spottail Shiner			1	2																5	13	18	0.9	
29	Rainbow Smelt			1																	8	7	15	0.8	
	Longnose Sucker													4	3						1	1	2	0.1	
	Longnose Dace	1																			1	0	1	0.1	
	Logperch																				1	0	1	0.1	
	Trout Perch																				0	1	1	0.1	
	Total	1	0	2	2	0	1	0	3	1	1	1	1	4	3	1	3	3	0	4	5	16	22	38	
Oct 25	Spottail Shiner	1																			1	5	6	0.2	
27	Rainbow Smelt		1																		2	0	2	0.1	
	Lake Chub																				0	1	1	-	
	Round Whitefish																				2	0	2	0.1	
	Gizzard Shad																				0	1	1	-	
	Alosi																				0	1	1	-	
	Total	1	13	0	3	0	13	3	1	1	1	0	0	0	0	0	2	1	1	0	27	1	28	0.9	
Nov 15	Spottail Shiner			1	1																3	11	14	0.4	
18	Lake Chub																				5	7	12	0.3	
	Rainbow Smelt																				0	1	1	-	
	Gizzard Shad																				1	0	1	-	
	Total	0	0	2	1	0	0	2	1	0	1	2	1	2	2	2	5	3	1	3	0	9	19	28	
Dec 13	Spottail Shiner																								
14	Rainbow Smelt	1		1																	0	1	1	0.1	
	Lake Chub	1			1																2	2	4	0.2	
	Total	2	0	1	1	0	0	0	0	1	0	0	0	0	0	2	1	0	0	0	2	3	5	0.2	
	Total May-Dec	77	45		109	88	90	103	222	69	86	132	384	507	1091										

* 48 h est
** 72 h est

APPENDIX 6

WATER TEMPERATURES ASSOCIATED WITH GILL NETTING

Dates	Transect, Depths				Set Day 1				Pull & Reset				Pull Day 2				Temperature Range		Thermograph location
					1-B	1-2	0-B	0-2	1-B	1-2	0-B	0-2	1-B	1-2	0-B	0-2	Probe	Thermograph	
May 16 set	Douglas Pt.	3	8.1	8.1	7.4	7.3			7.5	7.5	5.5	6.7							
17 reset		12							5.1	5.5	4.9	4.9							
18 pull	'B'	3											6.1	6.1	6.2	6.2	5.5-8.1	5.3-9.0	I-1,0-1
	Disch.	12							4.7	4.7	4.8	4.8	4.7	4.7	4.7	4.7	4.7-5.5		
	'B'	3											6.3	6.5	6.2	6.2	5.4-6.7	4.7-8.2	THB08-3
	Intake	12							5.9	5.9	5.4	5.4	5.1	5.1	5.1	5.1	4.7-5.1		
	Holmes Bay	3							4.9	4.9	4.8	4.8	5.3	5.3	5.9	5.9	5.4-6.1		
		12							6.9	7.0	5.9	5.9	5.3	5.3	5.3	5.3	4.9-5.3		
	Gunn Pt.	3	7.2	7.3					4.9	4.9	4.6	4.6	5.2	5.4	5.2	5.7	5.3-7.0		
		12							5.7	5.8	5.3	5.3	7.4	7.4	6.2	6.2	4.6-5.7		
									4.9	4.9	4.5	4.5	5.7	5.8	4.9	6.2	5.3-7.4	5.8-8.0	I-1
																	4.5-5.8		
June 20 set	Douglas Pt.	3	7.3	9.2	5.6	5.9			10.7	12.2	5.7	6.6							
21 reset		12	5.3	5.3	5.0	5.0			5.0	5.0	4.8	4.8							
22 pull	'B'	3	6.6	6.7	5.9	7.1							8.9	8.9	8.6	8.3	5.7-12.2		
	Disch.	12	5.1	5.1	4.9	4.9			11.1	10.9	5.9	8.0	6.8	6.8	5.5	5.5	4.8-6.8		
	'B'	3	6.8	6.8	5.9	6.3			4.8	4.8	4.6	4.6	6.1	7.8	7.5	9.0	5.9-11.1	4.5-9.8	THB08-3
	Intake	12	5.3	5.4	5.0	5.0			5.0	5.8	5.0	5.0	5.0	5.8	5.0	5.0	4.5-5.8		
	Holmes Bay	3	7.3	7.3	5.9	5.9			8.5	11.7	9.8	9.8	9.3	9.8	7.3	9.1	5.9-11.7		
		12	5.1	5.1	5.1	5.1			5.3	5.4	5.0	5.0	5.3	5.3	5.1	5.1	5.0-5.4		
	Gunn Pt.	3	5.9	6.0	5.5	5.4			6.2	7.3	5.9	5.9	7.1	7.1	6.6	7.5	5.9-7.3		
		12	5.1	5.9	4.9	4.9			5.0	5.0	4.9	4.9	5.8	6.7	5.1	5.1	4.9-6.7		
									5.6	5.6	5.5	5.5	6.8	7.3	6.0	6.0	5.4-6.8		
									4.9	4.9	4.7	4.7	5.6	5.6	5.3	5.3	4.7-5.9		
July 12 set	Douglas Pt.	3							17.8	20.0	16.5	16.6							
13 reset		12							16.4	16.5	16.4	16.5							
14 pull	'B'	3											18.6	21.6	17.3	18.4	16.5-21.6		
	Disch.	12							15.2	18.1	17.1	17.6	14.5	16.8	13.3	16.6	13.5-16.8		
	'B'	3							16.5	16.6	16.5	16.5	16.3	18.3	18.0	18.9	15.2-18.9	15.9-18.7	THB08-3
	Intake	12							17.5	18.6	17.2	18.0	17.4	17.9	16.8	16.9	16.5-17.9		
	Holmes Bay	3							16.5	16.8	15.9	16.5	19.1	19.2	17.4	18.8	17.4-18.6		
		12							18.8	19.0	17.3	17.3	16.6	17.2	17.1	17.2	15.9-17.2		
	Gunn Pt.	3							15.5	16.6	17.0	16.8	19.4	19.4	17.9	19.1	17.3-19.4		
		12							17.2	17.7	16.9	17.0	17.6	18.6	17.0	17.6	15.5-18.6		
									16.8	16.8	16.7	16.7	19.5	19.9	17.6	18.8	16.9-19.9		
													17.0	17.3	16.9	17.2	16.7-17.3		
Aug. 29 set	Douglas Pt.	3	23.2	25.8	20.3	21.1			22.4	22.8	20.4	21.7							
30 reset		12	19.0	19.9	19.5	20.8			19.2	20.2	12.3	17.6							
31 pull	'B'	3	18.2	23.1	22.5	22.8							21.5	21.7	20.8	21.4	20.4-25.8	20.6-23.0	I-1,0-1
	Disch.	12	19.3	20.1	10.6	13.1			18.5	19.9	22.0	22.3	18.5	19.8	13.7	14.8	12.3-20.8		
	'B'	3	21.7	23.0	19.8	20.4			19.1	19.6	10.2	13.9	17.7	21.5	21.3	21.5	17.7-23.1	21.3-23.1	THB08-3
	Intake	12	17.6	19.4	10.4	12.3			22.2	22.3	19.8	20.4	20.4	21.6	14.2	18.1	10.2-21.6		
	Holmes Bay	3	22.3	22.2	20.4	22.0			17.3	18.8	10.6	11.9	21.8	21.8	21.2	21.4	19.8-23.0		
		12	18.8	20.2	14.0	16.9			19.9	20.2	15.6	17.6	19.9	20.2	15.6	17.6	10.4-20.2		
	Gunn Pt.	3	22.5	22.6	20.0	20.4			22.2	22.2	20.7	21.9	21.9	21.8	21.9	21.8	20.4-22.3		
		12	17.9	19.7	16.6	19.5			15.5	18.5	11.7	13.3	18.4	19.7	17.2	18.9	11.7-20.2		
									22.1	22.2	20.7	21.9	21.8	21.8	21.2	21.7	20.0-22.6	21.7-22.5	I-1
									18.9	19.6	11.2	13.3	16.7	17.2	16.0	18.7	11.2-19.7		

Location codes: I-B, 1 or 2 inshore end of net, at bottom, 1 or 2 m off bottom
 0-B, 1 or 2 offshore end of net, at bottom, 1 or 2 m off bottom
 THB08-3 HS&D meter north of 'B' discharge transect at 3 m depth

APPENDIX 6 Continued

Dates	Transect	Depth	Set Day 1				Pull & Reset				Pull Day 2				Temperature Range		Thermograph location
			1-B	1-2	0-B	0-2	1-B	1-2	0-B	0-2	1-B	1-2	0-B	0-2	Probe	Thermograph	
Sept. 27 set 28 reset 31 pull	Douglas	3 m	17.4	19.0	17.4	17.4	17.5	19.9	17.5	17.5	17.6	19.0	17.4	17.4	17.4-19.9		
	Pt.	12 m	17.4	17.4	17.4	17.4	17.4	17.4	17.3	17.4	17.3	17.3	17.1	17.1	17.1-17.4		
	'B'	3 m	17.1	17.1	17.2	17.2	17.5	17.5	17.9	17.9	17.6	17.6	17.4	17.4	17.9-17.9	17.0-17.8	THB08-3a
	Disch.	12 m	17.3	17.3	17.3	17.3	17.4	17.4	17.4	17.4	17.3	17.3	17.3	17.3	17.3-17.4		
	'B'	3 m	17.0	17.0	17.2	17.2	17.5	17.5	17.5	17.5	17.4	17.4	17.4	17.4	17.0-17.5		
	Intake	12 m	17.3	17.3	17.3	17.3	17.5	17.5	17.3	17.3	17.3	17.3	17.3	17.3	17.3-17.5		
Oct. 24 set 25 reset 27 pull	Holmes	3 m	16.8	16.8	17.0	17.0	17.0	17.1	17.2	17.2	16.9	17.0	17.1	17.1	16.8-17.2		
	Bay	12 m	17.0	17.0	17.0	17.0	17.0	17.1	17.0	17.1	17.1	17.1	17.1	17.1	17.0-17.1		
	Gunn Pt.	3 m	17.1	17.1	17.0	17.1	17.1	17.1	17.0	17.1	17.1	17.1	17.1	17.2	17.1-17.2		
		12 m	17.0	17.0	17.1	17.1	17.2	17.2	17.3	17.3	17.2	17.2	17.2	17.2	17.0-17.3		
	Douglas	3 m	5.5	5.7	4.8	4.9	7.2	7.4	6.0	6.8	6.0	7.4	5.6	6.8	4.8-7.4		
	Pt.	12 m	4.8	4.8	4.8	4.9	5.7	5.8	5.5	5.5	6.0	6.5	5.4	5.7	4.8-6.5		
Nov. 14 set 15 reset 18 pull	'B'	3 m	6.1	6.3	6.0	6.0	6.0	6.0	6.4	6.4	6.4	7.6	6.0	6.0	6.0-7.6	5.9-11.2	THB08-3a
	Disch.	12 m	5.4	5.7	5.1	5.1	6.1	6.1	5.3	5.6	5.8	5.8	5.5	5.5	5.1-6.1		
	'B'	3 m	5.6	5.7	5.1	5.4	6.2	7.3	6.3	7.1	8.1	8.3	6.5	6.5	5.1-8.3		
	Intake	12 m	5.1	5.1	4.9	4.9	5.9	6.0	5.3	5.7	6.8	7.0	7.2	7.3	4.9-7.3		
	Holmes	3 m	5.7	5.7	5.2	5.2	6.4	6.6	5.5	6.2	8.3	8.3	8.1	8.1	5.2-8.3		
	Bay	12 m	5.2	5.2	5.5	5.2	5.3	5.4	5.4	5.4	6.9	7.8	6.1	7.3	5.2-7.8		
Dec. 12 set 13 reset 14 pull	Gunn Pt.	3 m	6.0	6.0	5.1	5.2	5.4	5.4	4.9	5.0	7.7	7.7	7.5	7.6	4.9-7.7		
		12 m	5.0	5.0	4.4	4.4	5.4	5.4	5.4	5.5	7.0	7.0	6.9	6.9	4.4-7.0		
	Douglas	3 m	6.4	6.4	6.5	6.5	6.6	6.6	6.6	6.6	6.6	7.2	6.4	6.4	6.4-7.2	6.3-10.5	1-1,0-1
	Pt.	12 m	6.4	6.4	6.5	6.5	6.4	6.4	6.4	6.4	5.9	5.9	6.2	6.2	5.9-6.5		
	'B'	3 m	6.4	6.4	6.4	6.4	6.0	6.0	6.0	6.0	6.3	6.2	6.4	6.4	6.0-6.4	6.2-11.2	THB08-3a
	Disch.	12 m	6.5	6.5	6.5	6.5	6.2	6.2	6.2	6.2	6.6	6.5	6.5	6.5	6.2-6.5		
Dec. 12 set 13 reset 14 pull	'B'	3 m	6.4	6.4	6.4	6.4	6.0	6.0	6.0	6.0	6.3	6.3	6.5	6.5	6.0-6.5		
	Intake	12 m	6.5	6.5	6.5	6.5	6.2	6.2	6.2	6.2	6.5	6.6	6.6	6.6	6.2-6.5		
	Holmes	3 m	6.3	6.3	6.4	6.4	6.0	5.9	6.0	6.0	4.7	4.7	5.0	5.0	4.7-6.4		
	Bay	12 m	6.4	6.4	6.4	6.4	6.0	6.0	6.0	6.0	5.3	5.3	6.2	6.2	5.3-6.4		
	Gunn Pt.	3 m	6.5	6.5	6.6	6.6	5.9	5.9	5.9	5.9	5.0	5.0	4.9	4.9	4.9-6.6	5.0-8.2	11
		12 m	6.6	6.6	6.6	6.6	6.1	6.1	6.1	6.1	6.0	5.7	5.0	5.9	5.0-6.6		
Dec. 12 set 13 reset 14 pull	Douglas	3 m	3.6	3.5	3.6	3.5	5.3	5.3	4.9	4.9	5.1	5.1	5.0	5.0	3.5-5.3		
	Pt.	12 m	4.4	4.4	4.4	4.4	4.6	4.6	4.6	4.6	4.9	4.9	4.9	4.9	4.4-4.9		
	'B'	3 m	6.8	6.8	3.8	4.0	4.2	4.2	3.9	3.9	5.9	6.0	5.3	5.3	3.8-6.8		
	Disch.	12 m	4.4	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.8	4.9	4.7	4.7	4.4-4.9		
	'B'	3 m	3.0	3.0	3.0	3.0	3.4	3.5	3.3	3.3	5.2	5.3	5.5	5.5	3.0-5.5		
	Intake	12 m	4.2	4.0	4.2	4.0	4.1	4.1	4.1	4.1	4.6	4.6	4.7	4.7	4.0-4.7		
Dec. 12 set 13 reset 14 pull	Holmes	3 m	2.9	2.9	3.0	3.0	3.3	3.3	3.3	3.3	3.9	3.9	4.1	4.1	2.9-4.1		
	Bay	12 m	3.0	2.9	3.0	2.9	3.1	3.1	3.0	3.0	4.8	4.8	4.7	4.7	2.9-4.8		
	Gunn Pt.	3 m	3.0	3.0	3.3	3.6	2.9	2.9	3.3	3.2	3.0	3.0	3.6	3.6	2.9-3.6		
		12 m	3.0	3.1	3.0	3.1	3.2	3.2	3.2	3.2	3.0	3.0	3.6	3.6	3.0-3.6		

Location codes: 1-B, 1, or 2 inshore end of net, at bottom, 1 or 2 m off bottom
 0-B, 1 or 2 offshore end of net, at bottom, 1 or 2 m off bottom
 THB08-3 HS&D meter north of 'B' discharge transect at 3 m depth

APPENDIX 7

FISH CATCH IN BEACH SEINES, BRUCE GS 'B' FISH CATCH, MAY- AUGUST, 1983

Location		Douglas Point			Bruce 'B' Intake			Holmes Bay			Gunn Point			Totals
Replicate		1	2	3	1	2	3	1	2	3	1	2	3	
May 18 Temperature		9.0°			9.0°			9.0°			6.2°			
Longnose Dace	Juvenile			1	9	7	8		12	4	17	1	29	87
	Adult			1	26	21	58	6	37	13	44	7	22	235
	Total			1	35	28	66	6	49	17	61	8	51	322
Bluntnose Minnow	Adult								2		2			4
Emerald Shiner	Juvenile					1		1						2
	Adult	1			2			1			2	1		7
	Total	1			2	1		2			2	1		9
Spottail Shiner	Juvenile						1		1		1			3
	Adult	5		1	3	2	8	14	4	1	4	8	1	51
	Total	5		1	3	2	9	14	5	1	5	8	1	54
Slimy Sculpin	Adult						1		2		1			4
Mottled Sculpin	Juvenile			1										1
	Adult							2	1	1		1		5
	Total			1				2	1	1		1		6
Rainbow Smelt	Juvenile	30	13	14	1		1	1	3		9			72
	Adult		1										1	2
	Total	30	14	14	1		1	1	3		9		1	74
Alewife	Juvenile				2	2		3		2	6	7	3	15
	Adult						6				6	7	3	16
	Total				2	2	6	3		2	6	7	3	31
Johnny Darter	Juvenile							1				1		2
	Adult			1				1				1		2
	Total			1				2						4
White Sucker	Juvenile	1									3			4
Lake Chub	Adult											5		5
Total Catch		37	14	18	43	33	83	30	62	21	89	31	56	517
June 22 Temperature		17.0°			15.0°			14.0°			13.0°			
Longnose Dace	Juvenile					1								1
	Adult	1	3	2	62	37	97	6	12	3	15	82	70	390
	Total	1	3	2	62	38	97	6	12	3	15	82	70	391
Spottail Shiner	Juvenile					1	3				3			7
	Adult	1	2	4	9	4	20	17	9	10		4	2	82
	Total	1	2	4	9	5	23	17	9	10	3	4	2	89
Emerald Shiner	Juvenile					1								1
Slimy Sculpin	Adult				1	2							1	4
Mottled Sculpin	Adult							2	1					3
Johnny Darter	Juvenile							5	8	5				18
	Adult			1			3	3	5	8		1		5
	Total			1			3	5	8	5		1		23
Alewife	Juvenile	1											1	1
	Adult												1	1
	Total	1												2
Lake Chub	Adult					1			1					2
White Sucker	Juvenile				3	4		1	4					12
Three-Spine Stickleback	Adult	1				1								2
Chinook Salmon	Juvenile				1	1	1							3
Rainbow Trout	Adult	1												1
Cyprinidae (unid)	Juvenile								1					1
Smallmouth Bass	Adult	1	1	1										3
Rainbow Darter	Adult												1	1
Total Catch		6	6	8	75	52	126	31	36	18	18	87	75	538

APPENDIX 7 (cont'd)

Location		Douglas Point			Bruce 'B' Intake			Holmes Bay			Gunn Point			Totals
Replicate		1	2	3	1	2	3	1	2	3	1	2	3	
July 12 Temperature		21.0°			20.0°			20.0°			20.0°			
Longnose Dace	Adult		*	*	19	33	1	19	4	3	23	37	19	158
Spottail Shiner	Adult				4	8	5	3	1	1	24	24	14	84
Troutperch	Adult				1						1	2	1	5
Slimy Sculpin	Juvenile											5	1	7
Mottled Sculpin	Adult							1				1		2
Yellow Perch	Juvenile							2	1			1		4
White Sucker	Juvenile					1								1
	Adult									1				1
	Total					1				1				2
Smallmouth Bass	Adult	1												1
Johnny Darter	Juvenile				1									1
Cyprinidae	Juvenile					4		20	10	13				47
Burbot	Adult										1			1
Total		1	-	-	25	46	6	45	16	18	49	70	35	311
August 23 Temperature		23.0°			20.0°			21.0°			20.0°			
Longnose Dace	Juvenile				37	70	160	15		21				303
	Adult			1	16	17	14	27	17	3	14	19	14	142
	Total			1	53	87	174	42	17	24	14	19	14	445
Spottail Shiner	Juvenile			1	10	19	10	45	67	68	3	1	1	225
	Adult				1		2	4	2	1				10
	Total			1	11	19	12	49	69	69	3	1	1	235
Emerald Shiner	Juvenile						1		1					2
Slimy Sculpin	Adult										2			2
Mottled Sculpin	Adult							1		1				2
Sand Shiner	Adult	1	1						1					3
Fathead Minnow	Adult							1						1
Smallmouth Bass	Juvenile	7	1											8
Cyprinidae	Juvenile									1				1
Lake Chub	Juvenile				10	7	13							30
Total		8	2	2	74	113	200	93	88	95	19	20	15	729
Total May-August		102			876			553			564			2095

*Hauls prevented by weather

APPENDIX 8

TEMPERATURES ALONG THE MEDIAN TRANSECT OF
ACOUSTIC GRID, AUGUST, 1983

Depth (m)	August 23			August 24		
	Inshore	Intake Depression	Offshore	Inshore	Intake Depression	Offshore
Surface	21.6	21.5	21.4	21.7	21.2	21.2
1	21.5	21.5	21.4	21.4	21.2	21.2
2	21.3	21.2	21.3	21.3	21.1	21.1
3	21.0	20.7	20.9	21.2	21.1	21.0
4	20.9	20.6	20.6	21.0	21.0	20.8
5	20.8	20.4	20.4	2.8	20.6	20.7
6	20.5	20.3	20.3	20.2	19.1	20.5
7	20.0	20.2	20.2	14.3	13.3	19.2
8	19.4	20.2	20.2	12.6	10.7	14.8
9	18.4	19.8	20.1	11.0	8.6	11.6
10	16.4	18.1	19.9	8.3	7.8	10.1
11		17.9	19.7	7.9	7.5	7.6
12		17.0	18.4	7.8	7.4	7.3
13		15.8	17.2		7.4	7.1
14		14.7	16.7		7.4	6.9
15		11.3	13.9		7.2	6.9
16		10.7	13.0		7.2	6.9
17		10.7	11.2		7.1	6.9
18		10.6			7.1	6.9
19		10.6				

APPENDIX 9

FISH CATCHES IN GILL NETS SET IN CONJUNCTION WITH ACOUSTIC FISH CENSUS

Sample		Net No	Depth (m)	Alewife	Smelt	Burbot	Lake Chub	Round Whitefish	Longnose Sucker	White Sucker
July 12	Day	1	12							
		2	12-16							
		3	12-16							
		4	18							
July 14	Day	1	12	3						
		2	12-16	35						
		3	12-16							
		4	18							
August 23	Day	1	10-12							
		2	12-16							
		3	12-16							
		4	18	1						
	Night	1	10-12	2						1
		2	12-16				1			
		3	12-16						1	
		4	18			1	1	1		
August 24	Day	1	10-12		1					
		2	12-16							
		3	12-16							
		4	18							
	Night	1	10-12	1			1			
		2	12-16							
		3	12-16				1		1	
		4	18				1			
Totals				42	1	1	5	1	2	1

Net 1 - East of intake, parallel to shore
 Net 2 - North of intake, perpendicular to shore
 Net 3 - Through intake depression, perpendicular to shore
 Net 4 - West of intake, parallel to shore